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ABSTRACT

This document is concerned with the practice of conservation of library materials in African university libraries south of the Sahara and north of the Limpopo. Data were collected using a questionnaire mailed to 42 university libraries in Sub-Saharan Africa. Responses were received from 27 libraries for a 64% response rate. Data analysis was conducted on all respondents. Ten chapters address the following topics: (1) the history of conservation efforts at local and international levels; (2) the climate of Africa; (3) biological agents of deterioration, including insect pests, disinfection and fumigation, fungi, termites, bookworms and silverfish, rodents/rats, human agents, and theft and vandalism; (4) physical agents of deterioration, including temperature, humidity, light/sunlight, and opening hours; (5) chemical agents, including intrinsic acidity and atmospheric pollution; (6) disaster planning; (7) the handling of materials; (8) preservation and conservation methods in Africa; (9) remedy measures of conservation; and (10) conclusions and suggestions. The survey instrument in included in the appendix. (Contains 64 references.) (JLB)

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The Practice of Conservation of Library Materials in Sub-Saharan Africa

by

M. E. OJO-IGBINOBA

African Studies Program
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MONOGRAPH ON AFRICANA LIBRARIANSHIP NO. 3

THE PRACTICE OF CONSERVATION OF LIBRARY MATERIALS IN SUB-SAHARAN AFRICA

BY

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DEDICATION

Dedicated to Doris and Nosa,
Abies, Osakpas, Uyi, Iguosa and Osaigbovo

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Ekpoma, Nigeria
October, 1992

M. E. Ojo-Igbinoba

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CHAPTER I

INTRODUCTION

There has always been need for mankind to conserve resources. Hence, there are various forms of conservation. Having acquired library materials, they need to be preserved to enhance accessibility to readers. Besides this, the influx of library materials into African university libraries in the past decade has been on the decline making it imperative to preserve what they have. It is high time African university libraries began to look seriously at the issue of preservation and conservation (PAC) if they are to play the expected roles of preserving the cultural heritage of the continent and support research which depends on the collections.

This monograph is concerned with the practice of conservation of library materials in African university libraries south of the Sahara and north of the Limpopo. For the avoidance of ambiguity, it is pertinent to define the use of some terms in this monograph. The term *conservation* has been variously defined and occasionally used interchangeably with *preservation*. The dictionary meanings occasionally do not clearly show the difference between the two terms. According to **Webster's Third New International Dictionary** (1961), the term *conservation* means the "deliberate planned or thoughtful preserving, guarding or protecting. Keeping in a safe or entire state." *Preservation* is similarly defined to mean, "keeping safe or protecting from decay. To restore is to rebuild, repair or reconstruct so that it is like original." The word *conservation* is further defined in the context of conserving cultural property by the U.S.A. National Conservation Advisory Council (NCAC) as involving the functions of "examination, preservation and restoration." That is to say, *conservation* is an attempt to use all of the library's resources to maintain the collection in a useable condition. *Conservation* is, therefore, a term used to describe *preservation* that is action taken to prevent, stop or retard deterioration and "restoration" is action taken to correct deterioration and alteration.

Conservation, as used throughout this monograph, encompasses preservation and restoration of intellectual property in print form and may be used interchangeably with preservation. The expressions library materials, bibliographic materials, and documents are used interchangeably to refer, in general, to all graphic materials (books, journals, reports, etc.) and other forms of photographic records such as microforms, phonograph records, magnetic tapes, films, etc. Books are, however, given the pride of place because of their predominance in African university libraries. *Smith (1986: 305)* asserts that "our libraries are the repositories of man's cultural heritage. If the materials in the World libraries (of which African University libraries are a part) are lost, the recorded history of human civilization is lost as well." University libraries are libraries writ-large.

The problems of conservation of printed materials have a long history. Since the time *Gutenberg* invented the printing press, there arose the need for a plentiful supply of cheap paper to feed the printing presses. The increased demand for paper led to changes for the worse in the paper-making processes. About 1850 paper for document production was made from wood-pulp sized with alum and rosin. Before the invention of wood-pulp paper, *Kathpalia (1982: 94)* says that printing was made on more durable materials like parchment, vellum, palm leaves and birchbark, clay tablets, stone, copper

plates, papyrus and cloth. According to *Schellenberg (1972: 164)* writing inks before the middle of the 19th century were of three types, namely, the so-called India ink, Nutgall ink, and Sepia ink, all of which were fairly permanent. Modern inks are produced from coal-tar. They carry within themselves the agencies of their own destruction. The materials that are in use in modern time include paper, films, tapes, printouts and punch cards among others.

Barker (1981: 193) noted that the international effort at the conservation of printed materials started in 1898 when the Prefect of the Vatican Library convened a Congress at St. Gall to examine ways and means of preventing, if not altogether stopping, the deterioration of wood-pulp paper. There are several factors necessitating the conservation of paper right from the earliest time.

1.1 Ancient Time

Before the twentieth century conservation and preservation practices were based on good storage. In old Africa, scrolls were kept in cylindrical boxes of wood or ivory, clay pots or pitchers, or wrapped in cotton or linen cloth to guard against dust and humidity. Dark places, windowless rooms, and rooms in the interior of houses were used to store materials to guard against the action of heat and light.

These ancient conservation techniques seem to have been successful for documents discovered in ancient tombs, courts, palaces, pyramids, temples, churches, and mosques which were found to be still in good condition. Arabic manuscripts, some wrapped in skins and in good condition, have been found in the mosques at Sankore, a great mosque and university in Timbuktu, and in Sokoto which were centres of Islamic learning and in several other places in the empires of central and western Sudan and in eastern Africa. *Balarabe (1990: 2)* and *Kensdale (1958: 55-57)* report the activities of universities in collecting Arabic manuscripts from all parts of West Africa and other parts of Africa. The cool interior of the buildings which usually had wide verandas or balconies and minimum light (small windows) in these places and good air movement in them, which created their own microclimate, seem to have been the major reason for this state of preservation. There is protective value in outer walls and enclosures.

Additional preservative techniques in use before the middle ages include storage in underground depositories/environments which existed in many less publicized places in Africa as in other continents. There was the use of cedar-wood oil and citrus oil as insect repellants in papyrus documents. Camphor, in the form of balls and blocks, cloves and clove oil, oil of eucalyptus and musk also were used. Modern practices have not completely overshadowed these techniques. For example, cedar-wood oil and camphor are still in use in parts of Africa as insecticides today.

1.2 Modern Time

Many organizations involved in conservation work are in existence. The Institute di Patologia del Librio established in Rome in 1938 was the first scientific restoration centre for books. In 1953 the Intermuseum Conservation Association (IMCA) was set up at Oberlin, Ohio, as a cooperative conservation effort in U.S.A. In 1957 the U.S. government established the Council on Library Resources which is responsible for much of what is known about conservation of library materials today. It funded the work of *William James Barrow (1959)* at Virginia State Library. Since Barrow's death in 1967, the Barrow Laboratory in Richmond has carried on his work. The Council also has funded

the conservation work of the Association of Research Librarians (ARL) which in 1960 established a Committee on the Preservation of Research Library Materials. The Library Technology Programme of the American Library Association also was funded by the Council. According to *Pakala (1978: 3)*, the Library of Congress has since 1967 established a conservation research laboratory which cooperates with the Barrow Laboratory, the National Bureau of Standards and the U.S. National Archives. Similarly, *Barker (1981: 193)* indicates that the British Library in 1976 appointed a Head of Conservation with overall responsibility for the binding and conservation of books and the overall preservation of its stock.

There is not as yet any comparable development in Sub-Saharan Africa and to my knowledge no African university library has as yet appointed a conservation librarian. However, it is a small world. African university libraries have learned a lot about conservation through the publications, seminars and training facilities of these councils, associations, and research institutes. IFLA and UNESCO have furthered these interests.

1.3 The Role of the International Federation of Library Associations

At the international level, the International Federation of Library Associations (IFLA) has set up a core programme on preservation and conservation based at the Preservation Office, Library of Congress, with regional centres in Germany and France. *Wachter (1986: 307)* notes that the Regional Centre in Germany established a restoration workshop at the Deutsche Bucherei (DB) in Leipzig in 1964 to translate research findings into the practice of large scale preservation and restoration involving mechanization and to improve the cost benefit ratio for these operations. It provides training for interested parties from any part of the world. The Centre in France was established at the Bibliotheque Nationale in 1979. Most university libraries in Francophone Africa normally send their personnel requiring training in conservation to the Bibliotheque Nationale. IFLA also encourages member associations to urge their national policy- making bodies to formulate national programmes for conservation and preservation of library materials. For Africa south of the Sahara UNESCO has established, in cooperation with the Nigerian Federal Government, a Centre for the Training of Museum Technicians at Jos. The course is open to students from Africa south of the Sahara. Its programmes at both the basic and advanced levels are pertinent to the training of conservation librarians, at least at middle management levels.

1.4 Methodology

A word about the methodology used for the survey conducted for this monograph is necessary. The instrument used in collecting data for the study consisted of a questionnaire developed to elicit conservation and preservation practices in university libraries in Africa south of the Sahara and north of the Limpopo. A sample questionnaire is shown in Appendix B.

Copies of the questionnaire were mailed to 42 university libraries in Sub-Saharan Africa. The reason for selecting university libraries rather than another library type is that they are research institutions which tend to be slow in weeding collections. Therefore, the need for conservation and preservation of their collections is very high. Secondly, university libraries in Sub-Saharan Africa also serve some functions of public libraries and are better funded than other types of libraries. They are, therefore, in a position to apply modern technologies to their conservation efforts. Furthermore, they

are in a stronger position as research institutions to carry out research in book conservation with a view to indigenising their strategies and identifying local sources of preservation materials or improvising with substitutes.

1.5 Sampling and Distribution

Forty-two questionnaires were mailed to university libraries in Africa south of the Sahara and north of the Limpopo. Responses were received from 27 university libraries. At 64% the response rate was encouraging and indicated the degree of interest in the subject. Responses came from all parts of Africa south of the Sahara and north of the Limpopo. The survey yielded the results tabulated below.

TABLE 1
GEOGRAPHICAL DISTRIBUTION AND
RESPONSES TO QUESTIONNAIRE

GEOGRAPHIC AREA	NO. SENT	NO. OF RESPONSE	%	NO. OF NO RESPONSE	%
Central Africa	7	3	7.1	4	9.6
East Africa	7	6	14.2	1	2.4
Southern Africa	7	7	16.6	-	-
West Africa	21	11	26.1	10	24.0
TOTAL	42	27	64%	15	36%

The higher number of questionnaires sent to university libraries in West Africa is indicative of the larger number of institutions of higher education there, especially in Nigeria, than elsewhere in Africa south of the Sahara and north of the Limpopo.

Most of the university libraries which did not respond were in Francophone countries: Zaire (3), Cameroon (1), Senegal (1), Niger (1), Côte d'Ivoire (1), Gabon (1), Chad (1), and Burkina Faso (1). The figure in brackets against each country represents the number of no responses. Perhaps the libraries found the language barrier insurmountable. Besides Zaire is currently a theatre of civil strife as are the Anglophone countries of Liberia (2) and Sierra Leone (1). The civil disturbances must have interrupted communication lines within these countries and outside preventing responses to the questionnaire.

In a survey of this type it is hardly feasible that every facet will be original. However, in the search for verifiable generalizations, an author may safely draw from fieldwork done by other scholars. This is part of the research method adopted in this monograph. Accordingly, published sources were searched such as **Library Trends**, **UNESCO Bulletin for Libraries**, library reviews, IFLA journals, and journals published in Africa. In addition, as many of the annual reports of these libraries one could find were searched for information. Interviews were sought and obtained with identified library janitors and supervisors of upwards of 20 years experience in the conservation and

preservation of library material. The focus of these interviews was on their indigenous conservation and preservation practices.

1.6 Data Analysis and Discussion

Data analysis was conducted on all respondents. Frequency distributions were generated using SPSS package on IBM PC Model 2 in the University of Benin Computer Science Department, Benin City, Nigeria to provide the basic statistics. The typescript was produced on Wordperfect Package.

The introductory chapter traces the history of conservation efforts at local and international levels, in ancient and modern times, the roles of IFLA and UNESCO, and the methodology. In Chapter II a general description of the climatic background of Africa is given. Chapters III to V treat agents of deterioration, their effects and peculiarity to Africa and in Chapter VI disaster planning is highlighted. Chapter VII describes handling of library materials, while Chapter VIII deals with the major methods of conservation indigenous to Africa. Chapter IX identifies remedy measures, the methods of restoration, removal of dirt, "cold" and "hot" lamination, encapsulation, binding and mending, trained personnel and/or expertise and awareness of restoration needs, while in Chapter X the summary, conclusions, suggestions and recommendations for ameliorating the conditions already highlighted are presented.

CHAPTER II

CLIMATE

The geographical location of any region and its climate is very important to the social, economic and political well-being of the region. The region under survey is located within the tropics of Cancer and Capricorn, latitudes 23.5° north and south. The region is bisected by the Equator, at which the sun is ever directly overhead at noon, giving 12 hours of daylight. The region is one of the warmest in the world, recording the highest temperature, the highest insolation, as well as net radiation throughout the year. Its climatic condition changes very little throughout the year, but it experiences great diurnal ranges.

Coremans (1968: 27) states that climate is the consequence of many elements and factors of varying nature, the main elements of which are temperature and sunshine, moisture (precipitation, condensation and humidity) which are influenced by factors such as latitude, altitude and prevailing winds. *Koeppe (1958)* classifies climates into 16 types. Of importance to this survey are the first three types of climate Koeppe identifies which include 90% of the tropical zone. Of these three the one most pertinent to this study is the one identified as the main part of South America, north of a line passing through Peru, Bolivia, Argentina, Paraguay and southern Brazil, and Africa south of the Sahara and into southern Africa including Madagascar. The area under survey is situated within this classification.

The climate within this region of Africa south of the Sahara and north of the Limpopo is hot and humid and is bounded at their poleward margins by hot and dry climate, for example, the desert region of north and central east Africa and practically the whole of southern Africa. The main characteristics of the hot and humid climate as presented by *Koeppe (1958)* are summarised in Table 2.

TABLE 2
MAIN CHARACTERISTICS OF HOT AND HUMID CLIMATES

CHARACTERISTIC	WET EQUATORIAL	TRADE WIND LITTORAL	WET AND DRY TROPICAL
Mean annual temperature	All months 21°C or more[1]	At least 21°C	At least 21°C
Annual ranges of temperature	Less than 3°C	Generally under 10°C	Under 8°C except in strong monsoon regions
Annual precipitation	At least 1,500 mm. All months moist[1]	More than 900 mm. No month rainless[1]	More than 900 mm. Distinct winter dry season[1]

[1] Including areas where altitude may reduce the temperature (as a rule 1°C per 200 m) and the annual precipitation.

Paden and Soja (1970: 23-25) have shown that rainfall in tropical Africa is closely associated with the migration of a zone of air-mass convergence known as the inter-tropical convergence zone (ITCZ) and with the exposure to the major rain-bearing winds. These variables, combined with more localised influences and the effect of middle-latitude circulation systems impinging on the northern and southern extremities of the continent, are the most significant factors in explaining the character of the major ecological zones (precipitation, climate, etc.).

In the equatorial regions outside the highlands of East Africa, the ITCZ never strays far, and annual rainfall is consequently quite high, reaching over 1600 mm in the Central Congo Basin and along the coast of Gabon, Cameroon and Nigeria where the rainfall is relatively evenly distributed throughout the year and the air is always moisture laden. Other areas of heavy rainfall include Guinea Coast (Guinea, Sierra Leone, Liberia), and the monsoons of the eastern coast of Africa. These areas are marked by seasonal variations of rainfall. Along the edges of the rainforest polewards is the grassland savanna. Here the summer rainy season, often similar to the rains of the tropical forests, alternates with the parching aridity of the dry season which has only about 30 mm rainfall towards the tropics of Cancer and Capricorn. The high temperatures are reflected in the data in Table 3.

TABLE 3
SELECTED CLIMATIC DATA: AVERAGE MONTHLY TEMPERATURES °C

PLACE	JANUARY (DRY SEASON)	JULY (RAINY SEASON)	RANGE
Dakar	28	21	7
Brazzaville	23	26	3
Luanda	18	26	8
Nairobi	16	18	2
Franceville	23	25	2
Southern Africa	19	26	7

Compiled by the author from **Africa Review** 1985, **Africa Guide** 9th edition, published by World of Information.

Generally, temperatures in January are cooler than in July, the height of the rainy season.

Temperature varies only slightly during the year relative to the great seasonal contrasts in rainfall throughout most of Africa. In the rain forest with its relatively even annual rainfall distribution, and in many coastal and highland areas there is usually less than 10° difference between the warmest and coldest months and frequently the difference is even smaller. Temperatures in the Congo Basin, for example, are consistently in the range of 24 to 27°C. Temperatures higher than this are usually

encountered during the summer months, polewards in the desert areas and much of the savannah region as reflected in Table 4.

In the higher elevations of Mambila and Jos (Nigeria) and the East African plateau, Bihe in Central Africa, and the Ubangi-Shari, the average annual temperature is about 20° less than that of the adjacent sea coast. The altitude produces what may be one of the most comfortable climates on earth. In the higher parts and several scattered mountain areas temperatures are cool enough to be distinguished as being closer to temperate than tropical climate.

TABLE 4
TEMPERATURE AND RAINFALL IN SOME SELECTED AFRICAN COUNTRIES

COUNTRY	TEMPERATURE IN °C			RAINFALL IN (mm)		REMARKS
	HIGHEST	LOWEST	RANGE	HIGH	LOW	
Republic of Benin	40	27	13	1600	220	Dry north, humid south
Burkina Faso	40	31	9	225	63	Hot dry
Cameroon	29	26	3	2000	1000	High humidity
Congo	25	16	9	2000	1100	High humidity
Ghana	42	29	13	1200	450	Dry and hot north, Humid south
Kenya	34	22	12	1800	1000	Temp. low as 6°C. Frost and mists in the highlands. Arid in parts
Nigeria	35	21	14	5000	500	Dry north, humid south. Temp. of 4°C at night in parts
Tanzania	35	20	15	1000	500	Great diurnal variation, small mean monthly: 2°C at Mwanza to 5°C at Dodoma
Uganda	29	27	2	1500	760	Low humidity. Temp. fairly constant throughout year
Zaire	32	27	5	2000	1000	Temp. varies greatly within the regions
Zambia	32	15	17	1200	600	Moderate climate
Zimbabwe	32	15	17	900	600	Temp. could be low as 13°C at night. Low areas warm all year

Compiled by the author from **Africa Review** 1985, **Africa Guide** 9th edition, published by World of Information.

Coremans (1968: 27) asserts that climatic conditions can be responsible for the decay of materials of all kinds. A conservation expert reporting on the main causes of deterioration of materials and possible methods of preservation will define the general characteristics of the climate so as to apply this knowledge to special cases. The climate of a large city within a country is different from a smaller one as well as the general climatic condition of the country. Large cities often receive less direct sunshine but more artificial heat from domestic and industrial fires, precipitation is heavier but the relative

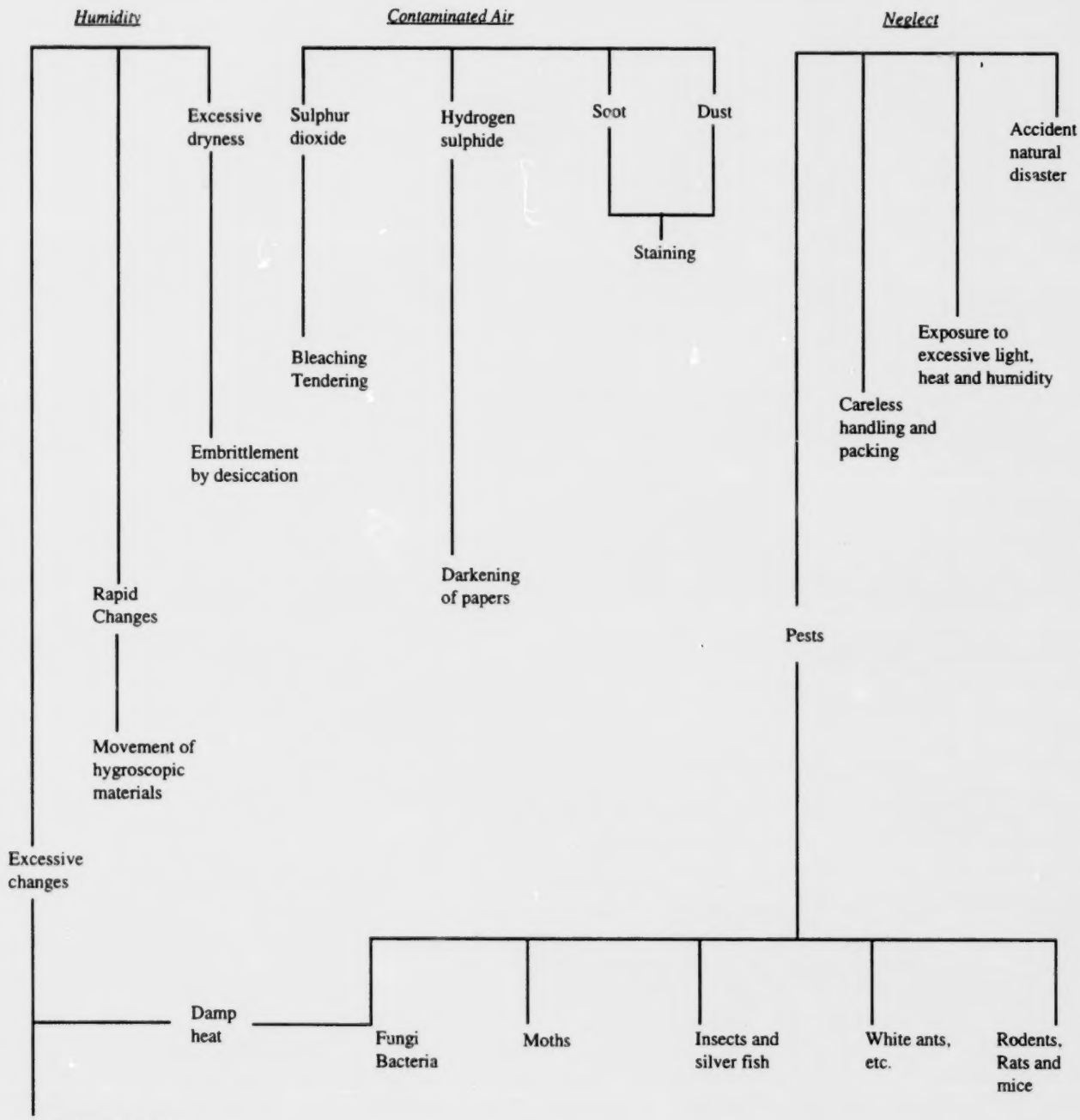
humidity is lower, and atmospheric pollution is much more pronounced. We shall often refer to climatic conditions in Africa throughout this monograph.

From every indication, the climatic and weather conditions in Sub-Saharan Africa are most conducive to the growth of fungi as daily, monthly, and annual mean temperatures are above 24°C, while the relative humidity caused by heavy rainfall is over the 65%.

Plenderleith (1956), as quoted by *Coremans (1968: 35)*, graphically outlines the causes of damage to library materials as adapted below. These include humidity, contaminated air, and neglect, each of which has a number of subdivisions as shown in Table 5.

TABLE 5

CAUSES OF DAMAGE TO LIBRARY MATERIALS



Adapted from Plenderleith

CHAPTER III

BIOLOGICAL AGENTS

3.1 Insect Pests

Among the most damaging of biological agents are pests. The **Concise Oxford Dictionary** (1963: 908) defines pests as "a troublesome or destructive person, animal or thing." It is certain that pests are animals or things which are destructive or inimical to the welfare of human beings. *Kumar (1984: iii-iv)* states that over one million species of insects are known and about 6000 new species are described every year. He adds that insects are terrestial animals most adaptable to changing food and climatic conditions. They are found in every conceivable habitat, from arctic snows to springs as hot as more than 40°C.

In the tropics where climatic conditions are more conducive to their rapid multiplication insects are all too familiar. Insects pests seem to be more of a tropical phenomenon than in other climatic regions. Thus, many countries of the northern hemisphere do not have as many insect problems, and, therefore, do not have facilities for fumigation. *Kathpalia (1982: 97)* stated that Belgium, Finland, the Netherlands, Norway, Portugal, Switzerland and 46 institutions mostly in France, Spain and the United Kingdom did not have fumigation facilities in 1982.

In contrast, insects, pests and a legion of microorganisms breed in the warm climate of the tropics. *Plumbe (1964)* has traced the history of attempts to prevent insect damage to books in tropical climates from about 1811 to just after the Second World War. He estimates that there are over 1200 species of cockroaches in existence, most of which are to be found in tropical climates, the most dangerous to books being the American species. Some countries have legislation about pests. In the U.S.A., in the Federal Insecticide, Fungicide and Rodenticide Act the term "pest" includes insects, rodents, fungi, etc. Such legislation is mostly lacking in Sub-Saharan Africa.

In view of the prevalence of pests in the tropics generally and in Africa in particular, it is necessary for libraries to take measures against them. This should be emphasised in view of the data collected in this survey which found that some libraries in Africa do not take any measures against insects and pests. The commonest measure taken against insects and pests by the responding libraries is the use of insecticides. Twenty-five of them or 92.6% use this method, while in answer to a related question, 48.1% of them say they use wire-mesh/net/screens on windows and doors to keep the insects out. Some 51.9% of the libraries claim to brush insecticides/insect repelling varnishes on the shelves. Only one institution (3.7%) claims to fumigate the collection against insects and pests. Insecticides are chemicals used to combat pests, and are at the moment man's chief weapon against insect pests.

In addition to these measures there is virtue in cleanliness. All the libraries clean their floors almost daily. Books and shelves are dusted often but not daily. Some 52% of the libraries wash the floors often. Cleanliness needs to be improved upon. In only a few libraries, as it has been observed, can one take down a book from the shelves without the need to wash one's hands afterwards. Also there should be periodic inspection of storage areas. In the effort to keep insects, including ants of all kinds, out of the library food items of all kinds and drinks should be prohibited. The survey found that the prohibition of food and drinks from the libraries applies more to patrons than to

staff. Yet staff members have a more important role in the prohibition. The cleanliness of staff areas should be pursued vigorously. Discarded food items and empty bottles should be removed daily and should not be allowed to stay overnight in staff areas unless the bins have secured covers.

The insecticidal sprays and repellants used in keeping the open and storage areas free from pests vary from library to library. Some use brand aerosol sprays. Other insecticidal sprays in use include pyrethrum mixed with D.D.T. in solution form and camphor, nephthalene or para-dichlorobenzene, such as dieldrin and dieldrex which are commonly used against termites. Also used against termites is Gamalin, a form of Gamma-BHC. A very effective preservation method is the use of fumigation with carbon dioxide or with methyl bromide. It is also cost effective.

Indigenous improvisation in the area of insecticides will be discussed in Chapter III. Although *Kumar (1984: 166-168)* discusses insect pest control with special reference to African agriculture, conservation librarians and technicians can study his book with profit. The dearth of conservation literature in African libraries is reflected by *Kumar* in another area. He states that most advances in our knowledge in insect pest control have taken place in the last thirty years. His survey of 20 universities and related libraries in East and West Africa revealed that 17 libraries had little or none of the pre-1975 literature cited in the book, and that the three remaining libraries had barely half of the post-1975 literature. Lack of current literature on the conservation of library materials, no less than in other disciplines, is endemic in African university libraries.

3.2 Disinfection and Fumigation

This operation is carried out in an oven which is hermatically sealed, and kept at a temperature of at least 30°C. It can be used to kill the eggs of insects. Insect pests that are already present often lay eggs in printed materials which are often hard to get rid of and are a source of re-infestation if there is any slack in control. In India sterilization against pests by exposing documents to a temperature of 65°C in a chamber for a short duration has been successful *(Kathpalia 1982: 96)*. It was found that the insects, their larvae and pupae, are eliminated as a result of this exposure without any visible damage to the quality of the paper. Similarly, according to *Roger Heim et al. (1975)* the Bibliotheque Nationale in Paris has used this method for many years with satisfactory results. Such a practice for conserving library materials is as yet lacking in Sub-Saharan Africa.

New stock should be vacuum fumigated with a lethal gas such as methyl bromide, sulphuryl fluoride, hydrogen cyanide, ethylene oxide, or carbontetrachloride to insure that pests are not brought into libraries from publishers' warehouses or other places of origin. Sulphuryl flouride and methyl bromide are recommended since they kill most insects in all stages of development. Both the Huntington Library and the National Archives in the U.S.A. use this fumigation method. In most African university libraries, new stock from publishers is unloaded directly to collection development and technical services divisions from where they are processed for patron use. Although fumigants are very effective means of controlling pests which are inside the leaves of books, facilities are not available for pre-service fumigation in most libraries in Sub-Saharan Africa.

3.3 Fungi

Fungi are non-green plants which do not generate chlorophyl and so do not produce their own food through photosynthesis. Lacking leaves, stems and roots, they depend on outside organic sources like cellulose for food. Fungi including mildew and mould are plant organisms that reproduce by means of minute spores. Although they are found in every clime and place, the optimum conditions for their growth is found in tropical climates. The problem of fungi is, therefore, acute in libraries in Sub-Saharan Africa.

Libraries in several countries reported the presence of fungi on books and documents. They often appear as whitish patches, but can assume many colours on books and documents and often are ignored in many libraries, perhaps through ignorance. Besides defacing books and documents with whitish, brown or greenish colour, and ruining book bindings and book paper, fungi provide nutrients for insects like psocid. They tend to thrive in libraries in Africa where there is ineffective circulation of air, books are packed tightly on the shelves thus impeding adequate circulation of air, and the relative humidity is higher than 70% and air temperature is between 18°C and 35°C. Their growth is assisted by the presence of moisture in the air and a substance like paper containing such elements as carbon, hydrogen, oxygen, nitrogen, sulphur and such trace elements as iron, zinc, and copper. They grow rapidly into millions of spores.

Two methods are used to control fungi growth on library materials. One is the application of suitable fungicides and frequent dusting of books and shelves. The other method is to control the relative humidity of the area while ensuring good air circulation. For fungicides, about a 5% mixture of ortho-phenyl-phenol or pentachloro-phenol with ethyl alcohol or methylated spirits can be applied to book covers or documents and then allowed to dry thoroughly before they are put back on the shelves. Formaldehyde is frequently used as a fumigant because of its additional fungicidal action. The second method for controlling fungi growth is airconditioning including the use of dehumidifiers to keep the air drier.

Generally, the responding libraries control or prevent fungi growth in the following ways. The circulation of air is enhanced by the use of fans, cross-ventilation, dusting and brushing of books and documents. Some libraries apply formaldehyde in a mixture containing a fungicide or lacquer containing shellac, a commercial preparation, phenol, paranitrophenol or similar substitutes.

There are other precautions which libraries should take to prevent the growth of fungi. Books should not be packed too tightly against each other on bookshelves so as to allow free circulation of air and lower relative humidity. The burning of several 100 watt electric bulbs continuously where possible, especially in stacks and basements which tend to be damp, will warm the air. Airconditioning of the rooms for at least eight hours daily will remove most of the problem. The airconditioning system should be fixed with a thermostat. The recommended temperature for most parts of Africa is a range of 21°C to 24°C and a relative humidity of 48% to 55%. Where airconditioning is not possible because of cost, the installation of dehumidifiers will help control fungi growth. Publishers can complement the efforts of librarians by producing books with covers which have smooth finishes rather than rough surfaces which retain dust and encourage the growth of fungi.

Dusting is the commonest method used in preventing fungi growth. Forty-eight per cent of the respondents use this method. Other methods used to prevent fungi

growth are sufficient ventilation (26%), fumigation (24%) and only 2% use airconditioning.

3.4 Termites

There are 1861 species of termites. Some live on dead wood, others live underground or in the open. Of particular concern is the specie called white ants, even though they are not white in colour, which feed on all things containing cellulose. In the library these include woodwork of buildings, books and documents, and photographs among other things.

Plumbe (1964: 6) and *Parker (1986: 23)* state that termites can do irreparable damage to structures and materials in a single night. In 1990 at Edo State University, Ekpoma, Nigeria, a newly delivered carton of books was left over night against a wall where there had been no visible indication of termite activity. The books were discovered the next day to have been eaten through by termites. There are similar reports of destruction from other institutions. Sub-Saharan Africa is said to be one vast termitary. Regular inspection of the library and its contents will easily detect the presence of termites by their long winding earthen tunnels which shelter them. Once the tunnels are destroyed, the termites are exposed to adverse conditions and move elsewhere or die. Termites do more damage to books and documents in Sub-Saharan Africa than time, wind, fire, flood and climatic conditions combined.

3.5 Bookworms and Silverfish

According to *Parker (1986: 15)*, Phillipus of Thessalonica used the word bookworm in the first century A.D. to satirise the then grammarians. Bookworm is a general word used to describe the beetle larvae which feed on paste and glue used on book spines and binding covers. A book attacked by bookworms is full of small, round holes gnawed by them.

Silverfish abrate paper surfaces and in the process erase the writing on the paper. They feed on glazed paper, starch, glue, pastes, dyes, the sizing in the paper and cellophane. Like cockroaches, they are mostly active at night. They are common in Sub-Saharan African libraries. Quite often they are destroyed by fumigation.

3.6 Rodents/Rats

Rodents are furry lower class mammals that gnaw their food. Some of them, like mice and rats, destroy library materials. They attack paper products to gain access to food, water and nesting sites and also cause deterioration by urinating and defecating on them. In addition they are disease carriers. One should be on the look out for their runs and holes and destroy them.

The survey reveals the presence and activities of rodents and the unending battle against them in university libraries. One is not surprised that libraries are not winning the battle, for once rodents have established themselves in a building, it is very difficult to get rid of them. The environment on Sub-Saharan African university campuses is very attractive to rodents. Food concessions are found in every conceivable corner, in some cases right in front of libraries. Associated with food concessions are rubbish heaps a stone's throw away. It is no wonder that well-fed rats are to be seen in most of the libraries under survey. Only 3.7% of the libraries surveyed replied with "No such problem" when asked what measures they take against rodents. The remaining

respondents use various brands of rodenticides like rat-killer or poisons, indocid capsules or simply "rigid cleaning." A combination of rigid cleaning and rodenticides will be more effective in decimating the rat population than rigid cleaning alone. In addition, all sewers, septic tanks and soakaways should be sited well away from the walls of the buildings.

The respondents were asked to name the measures they take against rodents in their various libraries. Their answers yielded the results tabulated below.

TABLE 6
MEASURES TAKEN AGAINST INSECTS/RODENTS

METHOD	NO. OF RESPONDENTS	%
Fumigation	1	3.7
Rodenticides	10	37.04
Poison/trap	14	51.86
Cleaning	1	3.7
No problem	1	3.7
TOTAL	27	100.0

3.7 Human Agents

Library pests are defined by *Thompson (1985)* as any humans, large or microscopic beasts that hamper or annoy the reader. Human beings are also library pests. *Adams (1937)* maintains that librarians are the greatest enemy of library materials. The contribution of man in the deterioration of library materials is both disturbing and ironic. Humans can cause untold damage to library materials when they leave steel pins, clips, staples which rust and stain the paper within a book, press back pages of a book, spill ink, paint or oil on the paper, mark, underline words within or scribble on a book, shelve books too tightly on the shelves, or use self-adhesive tapes on books in the name of repair. Angry people have even been known to set a library on fire. Damage of this type is found in Sub-Saharan African university libraries. In addition, there are acts of theft and vandalism and careless handling of books and documents.

3.8 Theft and Vandalism

There are as yet no known fool-proof preventives for library theft. Consequently, there will always be theft of library books as long as society remains as it is now. Our library books may be saved through extra vigilance and tighter security measures. However, breaches of security can occur through the failure of man or technology. A human security guard can make mistakes or other lapses creating loopholes for theft.

Power supplies often fail in Sub-Saharan Africa throwing the most sophisticated electronic surveillance gadgets into "epileptic fits" or complete blackout. The more so since most, if not all, libraries in Sub-Saharan Africa cannot afford uninterrupted power

supply. Where there are standby power generators, it takes some minutes for them to come on. In the intervening minutes thefts can occur, especially in countries where many people are poor but the premium placed on education is high. Although theft and mutilation affect the optimal use of the library resources, security planning to guard against theft has not been accorded high priority in university libraries.

Antwi (1989) states that university students steal library books because of selfishness, absence of borrowing privileges and blackouts among other reasons. He relates the story of a university student who confessed that he sneaks out books past confused gatekeepers. In view of this, the libraries were asked if they suffer blackouts or power cuts and if they have standby generators. The responses show that 22 or 81.5% of the libraries suffer power cuts and only five do not. It would appear that not all the 22 libraries which suffer regular power cuts maintain standby generators. Only 16 or 59.3% of the libraries indicated that they have standby generators for use in case of power cuts. It is surmised that the five libraries which do not suffer power cuts in addition to six out of the 22 libraries which have power cut problems do not have standby generators. These form 40.7% or 11 of the libraries as shown in Table 7.

TABLE 7
POWER CUTS AND AVAILABILITY OF GENERATORS

N = 27	SUFFER BLACKOUT		HAVE STANDBY GENERATORS	
RESPONSE	N	%	N	%
Yes	22	81.5	16	59.3
No	5	18.5	11	40.7
TOTAL	27	100.0	27	100.0

The chief instruments used for vandalising library materials are razor blades, penknives and scissors or by tearing out pages. These instruments are easily concealed and difficult for library management to detect. *Onadiran (1986)* describes the various types of deliquent users of libraries. *Wolfgang (1984)* said that book loses have always been a problem for libraries and discusses student attitudes to theft and mutilation. Trade literature on electronic gadgets and surveillance equipment for library use abound. However, electronic surveillance is hardly in use in the African university libraries surveyed. The major methods of preventing theft and vandalism are the enforcement of a closed access system (100%), the use of human security guards (100%) and combined, in some cases, with wire mesh on windows (74%), which also serves as a burglar proof.

A careful deduction from the replies of the responding libraries reveals that it is not uncommon to find members of the African university communities abusing library materials as delineated above. Examples from comments in this survey and facts garnered from library annual reports suggest that thousands of books are lost yearly through the deleterious activities of human agents, especially through theft and

vandalism. Many of the libraries now resort to holding exhibitions of vandalised books and documents in order to call attention to this unwholesome practice.

The suggested method of combating theft is that some form of electronic gadget, even ones that work epileptically, would need to be installed, especially the kind in which all library books are charged with a disc or metal strip slipped into the materials which then sounds an alarm when attempts are made to smuggle them through the gates unless they have been desensitized by proper checking out. All persons entering or leaving the library should use one gate. Other gates should be used only in emergencies. Only literate and trained security guards should be deployed as gatekeepers, porters or janitors, and they should be trained to recognise the library property stamp and date due stamp on books. The date due stamp should have some security design and the identity cards of users should be screened in order to check impersonators. The gatekeepers, porters or janitors should always be vigilant.

Libraries should pursue a progressive policy of staff development by exposing staff to workshops, conferences, on-the-job-training programmes and formal professional training for higher qualifications, especially in conservation and preservation in order to meet staff deficiency and the changing circumstances in librarianship.

CHAPTER IV

PHYSICAL AGENTS

Environmental differences have influence on the agents present in a given location and on the deterioration of library materials. The geographical location has influence on the activities of biological agents like fungi. The physical agents of deterioration are temperature (heat), humidity/moisture and sunlight.

4.1 Temperature

Changes in temperature affect the physical properties of all materials and also the rate of chemical reactions. Temperature activates deleterious agents like microorganisms, humidity and atmospheric contaminants which cause library materials to decay. It causes materials to expand and crack, to dry up and to become brittle. Library paper materials, therefore, deteriorate as a result of complex chemical reactions. Experiments in the physical sciences have shown that most chemical reactions vary directly with temperature.

According to *Thomas (1987: 5)*, the reactions speed up at higher temperatures and slow down at lower temperatures. This applies to paper deterioration for which research has confirmed that for every increase of 10°C, the rate of chemical activity doubles and thus the rate at which paper materials deteriorate also doubles. This presupposes, as *Akussah (1991: 22)* says, that if paper materials are stored at lower temperature, their life expectancy will be significantly lengthened. According to *Williams (1966: 53)*, the longevity of paper would increase seven and a half times for each decrease of 7.2°C. Paper stored at higher temperatures becomes embrittled, loses colour, etc. High temperatures also accelerate the rate of biological activities of insects, fungi, etc. Paper materials should be stored at 20 $\pm$ 2°C.

Most of Sub-Saharan Africa has high temperatures throughout the year. This can be seen from Table 8 which shows that the mean annual temperature is about 30°C. A closer look at the table will reveal that some towns recorded temperatures as high as 35°C. This situation is certainly in excess of the acceptable temperature. *Akussa (1991: 22)* states that librarians acknowledge and express concern about the effects of high temperatures on document life, but do not appreciate the adverse effects of diurnal range of temperature on the potential life of documents in the libraries. The major temperature problem is not the constant high temperature alone, but also the great diurnal ranges which can witness blistering heat during the day and frost at night. Many parts of Africa experience temperatures in excess of 30°C and as low as 6°C if not lower. The plateaus in Jos and Mambila (Nigeria) and in eastern Africa, Kenya and Tanzania experience this, and elsewhere usually whenever altitude reaches about 1,800 metres. Others have mean annual temperatures of 35°C and above, while temperature ranges are as high as 16°C. See Table 8 on page 20.

Excessive variations in temperature have more deleterious effects on paper materials than a constant high temperature. Frequent changes in temperature will cause materials to change dimensions. This poses a problem to complex documents like bound volumes composed of two or more substances each of which has a different coefficient of thermal expansion. Furthermore, temperature variations cause cellulose fibres of which paper is made to expand and contract over and over again, thus weakening them.

Standards specify that variations of temperature must be kept at a minimum low temperature of 1°C to 2°C. The African situation is high in relation to the standards since the diurnal ranges are wide. This will affect the life expectancy of library materials.

4.2 Humidity

Humidity or moisture is the term used to describe water in the air. Moisture in the air can be observed and felt in three states - gaseous, liquid, and solid. The control of gaseous water or water vapour is very important to librarians. A normal library building already protects personnel and materials from liquid and solid water but not water vapour. Humidity is the term used to refer to this water vapour. *Okata (1990: 8-9)* states that humidity can be relative or absolute. It is relative when at a given temperature, we express in ratio terms, the actual water vapour content of the air against the total it is capable of holding. It is absolute if we consider its mass over a given volume or unit of the air. Air, therefore, is said to be saturated when it is found to be holding the amounts of water vapour it is capable of holding at that temperature. This can lead to the formation of dew and we say the dew point has been reached.

Our interest in this information is based on the fact that the moisture content of the air at any given time is a variable of other factors. One such factor is temperature. It follows that the warmer the air, the higher the relative temperature. If warm air is to be cooled, effort should be made to extract the excess moisture that will result. Otherwise, the excess moisture within the library will condense and settle on library materials.

Humidity in all its ramifications affects both personnel and materials. It can make a person feel comfortable or otherwise. For example, cold air with high humidity would make one feel cooler than dry air of the same temperature. On the other hand, hot air with high relative humidity would make one feel hotter than it is. The same could be said of library materials which contain water in their natural state. A loss of this water or an increase has a negative effect on the life span of the materials. Loss of water causes the materials to dry up and become brittle and possibly disintegrate. Excess of water through increase in the environment or through hygroscopic absorption results in the dissolution of component materials like dyes and glues, and may even lead to a situation where the papers stick together and become inseparable.

Photographic materials are not spared as high humidity causes films to buckle or flutter and makes metallic reels corrode. As with paper low humidity can cause photographic materials to become brittle. The maintenance of this water level in libraries, the regulation of relative humidity, is very important. A relative humidity of 45-55% and a temperature of 20 $\pm$ 2°C is known to be best for paper preservation. For tropical regions an acceptable RH of 50-60% is suggested.

For most of Sub-Saharan Africa the relative humidity far exceeds this. At Accra it is between 69-95%, Lagos 85-95%, Zomba 56-79% and at Butare 55-67%. See Table 8. Ranges could be as high as 30-43% for some days. *Banks (1974)* advised that variations should ideally be kept within 6% from whatever level has been decided upon. Humidity and temperature situations in Sub-Saharan Africa are generally too high. It is clear that either humidity or temperature alone can be dangerous to library materials in African university libraries. But combined their effects are devastating.

TABLE 8
ANNUAL CLIMATIC DATA FOR SELECTED METEOROLOGICAL STATIONS IN AFRICA
(COMPILED FROM QUESTIONNAIRES)

ELEMENTS	STATIONS								
	ACCRA (GHANA)	IBADAN (NIGERIA)	KAMPALA (UGANDA)	LAGOS (NIGERIA)	MAIDUGURI (NIGERIA)	PORT HARCOURT (NIGERIA)	ZOMBA (MALAWI)	NAIROBI (KENYA)	BUTARE (RWANDA)
Mean Annual Temperature in °C	27	30	26	30	35	26	26	24	19
Lowest Annual Temperature	25	22	24	21	19	27	16	10	11
Highest Annual Temperature	30	35	35	35	41	29	36	26	25
Annual Temperature Range	3	8	9	9	16	3	10	12	6
Daily Variation of Temperature:									
Min.	25	28	24	32	30	26	19	23	15
Max.	27	35	35	35	36	29	30	26	26
Daily Range of RH: Relative Humidity %	45-96%	70*-90%	40-65%	85-95%	32-65%	85-90%	56-79%	55-70%	55-67%
Mean Daily Duration of Sunlight Hours	7	5.1	12	8	9	8	8.1	8.5	9

**Generally, RH is higher in the mornings at 6-7 a.m. than at noon.*

4.3 Light/Sunlight

Light is very important in the provision of library services especially since materials have to be viewed and read. Yet light is one of the greatest enemies of paper. Both artificial light (controllable) and sunlight (less controllable) are useful in library services. But all types of light contribute to paper degradation and fading of pigments and dyes. Throughout tropical Africa the light is stronger and in many parts a combination of high temperature and high humidity favours rapid growth of moulds. *Duchein (1985: 463)* points out that "the light in tropical countries owing to the height of the sun above the horizon and the degree of ozonisation, is particularly rich in sunrays."

Light is necessary for the ordering of the library system. But too much light is bad, being responsible for the major part in deterioration of library materials. A brief description of the tropical climate has been given. Light is from two sources: sunlight and electrical light which can be incandescent or flourescent light. Incandescent light poses very little problem, if any. The invisible ultraviolet component of sunlight, daylight and flourescent lighting is relatively the most harmful of all and should be eliminated. *Buchberg (1983: 35)* states that ultraviolet light is the most deleterious. The effects of ultraviolet rays in sunlight and flourescent light on printed materials are usually seen on faded covers and discoloured pages. *Shuhaimi (1986: 5)* points out that the rate of damage to paper depends on the intensity of the light and the length of exposure. The higher the intensity of light, the greater the damage.

The physical damage on the paper is not only seen but is quantifiable in that the paper becomes brittle, breaking into pieces on handling. Added to this is the fact that books and documents damaged by sunlight become unaesthetic, having lost the beauty of their original colours. This can be seen especially on books and documents near unprotected windows. Under the influence of light a complex series of reactions occur leading to embrittlement and discolouration especially in sulphite paper and newsprint. A day's exposure to strong sunlight in the tropics, for example, will visibly discolour newsprint.

Light can be controlled by the orientation of the library building and the protection afforded the contents. This is the standard method employed in tropical architecture to eliminate both sun and glare from the sky. Library buildings should be constructed in such a way that direct sunlight is excluded from the rooms, stacks or storage areas. Direct sunlight can be controlled architecturally and excluded from the interiors of buildings by the use on north and south sides of overhanging eaves or horizontal protections and on east and west sides by vertical shades. Other light and reflections can be reduced by use of tinted glass louvres and blinds. Artificial lighting can be provided by diffused lighting of varying intensity as desired in the various areas of the library. Reflections from nearby buildings can be controlled by choice of paints on facing exterior walls. For example, *Cunha and Cunha (1966)* state that the use of white paints (titanium dioxides) on the walls and ceilings of storage areas will help remove about 90% of the ultraviolet rays in the unfiltered intense sunshine reflected from such white surfaces.

4.4 Opening Hours

The respondents were asked to state library opening hours and the mean duration of sunlight hours per day. The majority 81.5% or 22 out of 27 of the libraries are open 10-14 hours daily, Monday to Friday and for shorter hours at the weekend. The average

sunlight hours per day range from 5.1 hours (Ibadan) to 12 hours (Kampala). These figures are high when viewed against the number of hours the libraries remain open during the day. The hours of sunlight coincide with the hours of opening. Flourescent lights used for viewing and reading in most of these libraries are a powerful source of ultraviolet radiation. All these, cumulatively, have a devastating effect on books and documents. The summary of climatic observations for the big cities in Africa which are also centres of university libraries reveal that the sunshine hours per month range from 100-200 hours or more. This range is most unfavourable for books and documents.

CHAPTER V

CHEMICAL AGENTS

5.1 Intrinsic Acidity

The process of papermaking involves the use of chemicals either to bleach, remove undesirable contents of wood-pulp and/or to add quality to the end product. It is necessary to discuss this as part of the chemical agents responsible for the deterioration of library materials. Cellulose, the major constitution of wood-pulp paper, is basically carbohydrate. Cellulose is made up of fibres which are joined together by lignin. The sugar and lignin are removed in the process of making wood-pulp paper by the use of chemicals which are washed off. The degree to which the washing is done determines to a large extent the purity of the paper.

Historically acid was introduced into paper in the form of alum (potassium aluminium) added to tube-sizing. Papermakers also use chlorine for bleaching. The use of chlorine has been described by *Alegbeleye (1988a: 4-5)* as "unmitigated disaster to us information professionals." In 1807, *Moritz Illig* demonstrated the safe, simple and cheap method of sizing paper by adding alum-rosin boiled with soda to make soap (sodium resinate) to the beater followed by alum. The resulting paper from the alum-rosin size has sufficient strength and water repellency to facilitate any writing in ink. Fillers or loadings are added to coat the paper and make it opaque. Fillers are derived from china clay, pigments and chalk. These are sources of nutrients to fungi.

According to **Compton's Encyclopaedia** (1966) sizes are derived from animal gelatin, resins, alum, starch, and gypsum. However, a combination of high temperature and high humidity only accelerates the action of alum-rosin size to generate sulphuric acid in paper. As *Woodlee (1988: 7)* says, rosin size is acidic and has been found to accelerate the chemical deterioration of paper. Mechanical pulping/groundwood processes from which many papers in our libraries are made contain lignin, a complex organic compound which breaks down to form a number of components, some of which are acidic. These components result in the darkening and consequent embrittlement of paper. The chemical wood pulp process of paper manufacture in which non-cellulytic material is separated from the fibres by "cooking" also introduces intrinsic acidity in paper. Many paper mills in Africa use this process. About 85% of the book materials in African university libraries are gradually decaying through these processes.

5.2 Atmospheric Pollution

The chemical composition of atmospheric air, mostly its oxygen, makes it an active agent of decay, whether polluted or not. Additional impurities are brought by the activities of man or nature. The atmosphere, especially in the industrialised world, contains a lot of industrial pollutants in varying proportions. According to a 1992 WHO publication *(Observer 1992: 7)*, African villages and cities are likely to experience two types of air pollution problems: industrialised pollution from large uncontrolled sources, such as power stations, cement plants, paper mills, and chemical plants, and vehicular traffic with emissions from cars, buses and trucks, many with diesel engines. All of these negatively affect library materials and personnel.

CHAPTER VI

NATURAL DISASTERS

6.1 Natural Disasters

There are some occurrences in the environment which can be classified as natural disasters even though their causes are artificial. These disasters could be fire, flood, riot or war. Disaster planning involves the taking of certain purposive actions to prevent disaster and if it does occur to have ready made plans for salvaging and coping. Fire has remained an ancient scourge of libraries. The incidence of fire in modern times has been exacerbated by the introduction of electrical wiring methods with their attendant problems. For effective fire control there must be capability to detect the occurrence and the taking of appropriate steps to put the fire under control.

Paradoxically, our libraries provide an ideal environment for fires to develop since they include combustible matter and materials that support combustion, namely books, documents, and wooden furniture. Librarians have little or no control over these matters. The only course open to them is to take precautions against fire in the libraries. The damage caused by fire is often compounded by the water used to extinguish it. Fires have occurred in the libraries surveyed.

The usual precaution against fire is chiefly the prohibition of smoking in the libraries. Some 92.6% of the libraries ban smoking, while 77.8% of them prohibit naked lights. See Table 9. Should there be an incidence of fire, all 27 libraries (100%) depend on the use of hand held fire extinguishers. Only seven (25.9%) of the libraries have in-house fire departments. Other methods taken against accidental fire are the use of conduit electrical wiring and providing main control switches in easily accessible areas.

TABLE 9
PRECAUTIONS AGAINST FIRE OUTBREAK

N = 27	FIRE EXTINGUISHERS		FIRE DEPARTMENTS		NO NAKED LIGHTS		NO SMOKING	
RESPONSE	N	%	N	%	N	%	N	%
Yes	27	100	7	25.9	21	77.8	25	92.6
No	-	-	20	74.1	6	22.2	2	7.4
TOTAL	27	100	27	100.0	27	100.0	27	100.0

Most of the libraries do not have an automatic fire fighting system. Only three or 11.1% of them have the capacity to flood the fire area with high expansion foam. Four or 14.8% of the libraries have installed a hydrogenated agent system. Table 10 below gives the details.

TABLE 10
EQUIPMENT FOR FIRE EXTINGUISHMENT

N = 27 EQUIPMENT/RESPONSES	YES	%	NO	%	TOTAL N	TOTAL %
Automatic sprinkler systems	5	18.5	22	81.5	27	100
Flooding with CO_2	9	33.3	18	66.7	27	100
Flooding with expansion foam	3	11.1	24	88.9	27	100
Hydrogenated agent system	4	14.8	23	85.2	27	100

6.2 Use of Fire Resistant Materials

In the event of fire outbreak, the use of fire resistant materials in buildings in preventing the spread of fire becomes important. Nineteen libraries or 70.4% have used fire resistant materials in their buildings, but only six or 22.2% specified the use of fibre glass and asbestos as shown in Table 11.

TABLE 11
USE OF FIRE RESISTANT MATERIALS

N = 27 MATERIALS/RESPONSES	YES	%	NO	%	TOTAL N	TOTAL %
Use of conduit wiring	18	66.7	9	33.3	27	100
Use of fire resistant materials	19	70.4	8	29.6	27	100
Use of steel doors	4	14.8	23	85.2	27	100
Use of steel shelves	23	85.2	4	14.8	27	100
Use of fibre glass and asbestos	6	22.2	21	77.8	27	100

6.3 Capability in Fire Extinguishment

The majority of the libraries have little or no capability in fire extinguishment as shown on Table 12. Only five or 18.5% of the libraries have fire drills for personnel and only 40.7% or 11 libraries have trained staff in fire extinguishment. The majority (55.6%) seem to depend entirely on fire brigades near the library in the event of a fire. However, fires have been known to consume whole buildings before the arrival of fire brigades.

TABLE 12
CAPABILITY IN FIRE EXTINGUISHMENT

N = 27	TRAINING IN FIRE EXTINGUISHMENT		EXPERIENCE IN FIRE EXTINGUISHMENT		FIRE DRILLS		FIRE BRIGADE NEAR LIBRARY	
RESPONSE	N	%	N	%	N	%	N	%
Yes	11	40.7	12	44.4	5	18.5	15	55.6
No	16	59.3	15	55.6	22	81.5	12	44.4
TOTAL	27	100.0	27	100.0	27	100.0	27	100.0

There is a general lack of appreciation of the possible havoc a fire could wreck on a library. The absence of modern equipment for fire fighting in the libraries indicates that they would rather depend on luck and God for their basic protection than on acquiring the physical tools required to protect them from the wrath of fire. The libraries hardly consider insurance of the library building and its contents. *Alegbeleye (1988a: 5)* surveyed 20 Nigerian libraries with regard to insurance coverage for their libraries. He found that the 20 libraries have no insurance for the buildings and only one insured its library materials. Such a situation is parlous. If similar conditions are found in other countries, obviously there is a need for greater efforts on the part of the libraries in these matters. In addition to the use of fire extinguishers with carbon dioxide and halogens, water sprinkler systems with heat control, water pipes and hoses should be installed to supplement fire fighting facilities in libraries. The library building and its content should be insured.

6.4 Fire Detection Devices

As for disaster detection devices in the buildings, 17 or 63% of the libraries surveyed do not use any of the modern techniques of providing security for their collections. The use of heat sensors or smoke detectors are not emphasised in planning library buildings in Sub-Saharan Africa. The majority or 92.6% of the respondents depend on human security guards.

TABLE 13
DISASTER DETECTION DEVICES

N = 27	FIRE DETECTORS		HUMAN SECURITY GUARD	
RESPONSE	N	%	N	%
Yes	2	7.4	17	63
No	25	92.6	10	37
TOTAL	27	100	27	100

It should be emphasised that the heavy reliance on human guards for the detection of the occurrence of fire may be unreliable. Human guards may fail because of

fatigue or other causes. Secondly, human guards are effective only in a limited fire. They are most likely to be ineffective in preventing or controlling large scale fires. The third problem in the use of guards is the time lapse between the actual development of a fire and its discovery and extinguishment. Time is always a critical factor in fire fighting. The period between the start of a fire and its development from low to high level is often short, usually between 5 to 20 minutes after which it may be uncontrollable.

A combination of modern in-house devices and human security guards would assure the library collection a greater protection. Of greater importance is the training of all library personnel in fire fighting techniques so that they can effectively use available equipment. We have seen that 59.3% of the respondents have no trained personnel in, and 55.6% of them have no experience in, fire extinguishment. All library personnel without exception should be taught how to operate fire extinguishers for combating accidental fires. Also there should be fire drills which 81.5% of the libraries do not take seriously at present. The drills are meant to train personnel how to react to an actual fire outbreak. The importance of such drills is to put library personnel in a state of combat readiness physically and psychologically. Fire drills should take place several times a year to familiarise library personnel with emergency exits, evacuation of records and shelflists, and communication with the fire station for outside help. The main problem of fire fighting in Africa is the poor communication links between the libraries, the public and the fire service. Often there is shortage of water to combat the fire as well.

6.5 Flood

Besides fire, water in form of rain, flood from a rainstorm, blown off or leaking roofs or water used to quench fires are common occurrences. Rainfall is heavy in the tropics and this affects buildings, especially libraries. Flood, which is a phenomenon closely related to the rainfall pattern, has wrecked havoc in various parts of Sub-Saharan Africa. The main precaution against flood in the libraries surveyed is a raised foundation such that any flood in the area does not enter the libraries. Some 66.7% or 18 of the libraries have storm drains to carry away excess water arising from rainstorms in the vicinity of the libraries. Floods can occur from faulty plumbing, airconditioners, leaking taps and so on. Some libraries in Nigeria have reported having airconditioner holes which need buckets to catch the floods whenever it rains. These are minor inundations compared with possible inundation from leaking roofs.

6.6 Effect of Roof Types

Flat roofs are more susceptible to leakages and thus permit the incursion of water or rain more than ridged roofs. Flat roofs also allow dirt and debris to accumulate and vegetation to grow on them thus encouraging water retention which may lead to cracks. Ridged roofs allow rain water easy flow. The stability of the roof also depends on the strength of the anchorage to the walls. This is important as rain storms frequently ravage parts of tropical Africa especially during the rainy season.

In view of these problems associated with roofing and their link with flood, respondents were asked what type of roofing was used for their library building. Seven libraries or 25.9% have flat roofs while 20 libraries or 74.1% have ridged roofs. The responses are set out in Table 14 on precautions against flood.

TABLE 14
PRECAUTIONS AGAINST FLOOD

N = 27	PROTECTION AGAINST FLOOD		STORM DRAINS		FLAT ROOF		RIDGED ROOF	
RESPONSE	N	%	N	%	N	%	N	%
Yes	23	85.2	18	66.7	6	22.2	20	74.1
No	4	14.8	9	33.3	21	77.8	7	25.9
TOTAL	27	100	27	100	27	100	27	100

6.7 Equipment for Paper Treatment

The effect of floods like that of fire can often be catastrophic. One of the most visible consequences of flood and water is the tearing and crumbling of sheets of paper, the running or bleeding of ink, the disintegration of adhesives, the warping of book covers, sometimes the separation of the emulsion of layers of wet photographs from their film base, and finally the likelihood of library materials made of coated paper sticking together. Also there is the possibility of mould growth on wet and damp library materials after 72 hours of being so affected. Many countries including Ghana and Nigeria have experienced floods which destroyed valuable library materials and documents.

It was necessary to find out the available equipment for treating books damaged by water in these institutions. It is one thing to take precaution against flood. It is, of course, another thing to restore or treat soaked library materials and documents. Valuable equipment necessary for treating damaged library materials was listed, such as electric fans, cold storage, and humidifiers. None of the 27 university libraries indicated possessing cold storage, freeze drying, dehumidifiers or vacuum drying facilities. The inference here is that faced with a fire or flood disaster, resulting in books damaged by water, the university libraries would resort to the most convenient and not necessarily the most efficient method of book restoration - the use of electric fans for ventilation and natural sunlight. This survey yielded the following results in Table 15.

TABLE 15
EQUIPMENT FOR TREATING WATER-DAMAGED BOOKS

METHOD / FREQUENCY AND %	YES	%	NO	%
Fans	27	100	-	-
Cold storage	-	-	27	100
Freeze drying	-	-	27	100
Dehumidifers	-	-	27	100
Vacuum drying	-	-	27	100
Humidifiers	-	-	27	100
Others: Natural sunlight	27	100	-	-

6.8 Skill in Paper Repairs Post-Disaster

Knowledgeable personnel are the key factor in any disaster control and recovery. The institutions were asked if they have staff with the requisite skill in paper repair work or conservation for post-disaster recovery operation in the event of fire or flood. The majority (92.6%) of the institutions report having no skills at all in paper repairs or conservation. Only 7.4% of them indicated having staff with the requisite skills.

6.9 Earthquakes

Earthquakes are a rapid movement of the earth's crust which may vary in intensity from the faintest tremors only detectable by means of the most delicate and sophisticated instruments to shocks of catastrophic proportions which may not only result in loss of life and destruction of valuable property but may produce remarkable effects. Within the last two decades, more than 56,700 persons have died and properties worth 50 billion dollars lost through the occurrence of earthquakes in the world. In Africa a few incidents of earthquakes and volcanic eruptions have been reported in Nigeria, Ghana, Liberia, Cameroon and some East African countries, part of the landmass geographically prone to earthquakes. In recent times their frequency and geographic spread have made a call on safeguards and contingency as timely and imperative.

In the data in Table 16 below, eight respondents claim that their countries are in the belt prone to earthquakes. An equal number of the respondents claimed that their libraries are built within the earthquake belt in their countries. As regards the precaution taken by these institutions against earthquakes, 12 or 44.4% of them have no safeguards whatsoever. The other 15 or 55.6% claim that their libraries are built on extra solid foundations.

TABLE 16
ZONE PRONE TO EARTHQUAKES

N = 27	COUNTRY IN ZONE PRONE TO EARTHQUAKES		LIBRARY IN AREA PRONE TO EARTHQUAKES		PRECAUTION TAKEN (SOLID FOUNDATION)	
RESPONSE	N	%	N	%	N	%
Yes	8	29.6	8	29.6	15	55.6
No	19	70.4	19	70.4	12	44.4
TOTAL	27	100.0	27	100.0	27	100.0

Countries should build structures, especially libraries, with earthquakes in mind. With modern development, no part of the world can be said to be free of earthquakes. Scientists have linked human activites to bigger future earthquakes. Both *Chinwa (1991)* and Dr. Evans Aina *(Aderibigbe 1992)* have identified such human activities as mining operations, construction of dams and reservoirs and underground nuclear explosions as common causes of earthquakes. For example, the period of the Gulf War in 1991 produced 77 earthquakes, while in the same period in 1989 there were 16 earthquakes and in 1990 13 earthquakes occurred.

The rockmass of the earth can break up as a result of the rotation of the earth and this can lead to earthquakes. Added to this are the effects of large scale dams for hydroelectricity and irrigation projects, very necessary in Africa, but which tend to induce earth tremors in the regions where they are sited. Dr. Aina *(Aderibigbe 1992)* warns against indiscriminate construction of dams so as to prevent earthquakes or earth tremors. He adds that construction of dams is the agent of earthquakes as shown by studies in America. The study indicated that 10-15 years after construction of a dam people living nearby begin to experience hints of earth tremors. Such tremors may trigger earthquakes.

Earthquakes have occurred recently in Guinea and the Lake Nyos catastrophy in Cameroon has necessitated new thinking about the immunity of West Africa to such a natural disaster. The occurrence of earth tremors in recent times in Nigeria has been reported in **Punch** (Elumoye 1991). Earth tremors caused quite a scare at the main campus of Uthman dan Fodio University, Sokoto, Nigeria in June, 1990. Similarly, in July, 1984, Ijebu-Ode and environs in Ogun State, Nigeria which has a university, experienced an earth tremor during which bottles fell off tables and pictures hung on walls crashed to the floor. This happened thrice in one week. In the same period Ibadan, Nigeria was thrown into a state of confusion on July 28, 1984 by an earth tremor.

There are extinct volcanoes in many parts of Africa. For example, 10 extinct volcanoes exist in Nigeria at Borno, Jigawa, Taraba, Adamawa and Plateau States which are university and potential university towns. These extinct volcanoes may become active again. Most fire safety codes provide for the use of non-combustible materials, provision of fire gadgets, access to water supplies, firemen's lifts and so on. The formulation of

national fire safety codes and adherence to their provisions in the construction of buildings, especially library buildings, is recommended.

6.10 Riot/War

War means a conflict among political groups especially sovereign states carried on by armed forces, sometimes of considerable magnitude and sometimes for a considerable length of time. Riot is a civil insurrection. War is a phenomenon that transcends space and time and has often been characterised by its ferocity and destructiveness. One only needs to compare the crude weapons used by mankind's ancestors with the precision and destructiveness of, for example, the missiles used in the "war of the cities" between Iraq and Iran or between Israel and its Arab neighbours to be convinced of man's progress in self-destructiveness. The loss of books and vital documents, and the destruction of libraries due to war is a worldwide phenomenon.

African university libraries have not managed to escape from the ravages of riot or war. For example, during the 1967-70 Nigerian Civil War the bibliographic resources of the library of the University of Nigeria were looted or completely damaged and several catalogue cabinets with their contents were lost. More recent are examples from Sierra Leone, Liberia, Zaire and Zimbabwe. Eleven or 40.7% of the respondents have experienced riot or war in their areas. The majority of the institutions have not experienced any. Only one library (3.7%) suffered destruction worthy of note.

TABLE 17
RIOT/WAR

N = 27	HAVE EXPERIENCED RIOT/WAR		EFFECT ON LIBRARY	
RESPONSE	N	%	N	%
Yes	11	40.7	1	3.7
No	16	59.3	26	96.3
TOTAL	27	100.0	27	100.0

CHAPTER VII

HANDLING OF LIBRARY MATERIALS

7.1 Handling of Library Materials

A look at the circulation statistics of African university libraries would indicate that they experience far more use year by year due to the ever burgeoning enrolments and, therefore, more handling with greater possible physical damage. This use involves not only reading, interlibrary loans, but also photocopying. There is great hunger for education in Africa but most parents are too poor to buy books for their children. Students in the universities depend heavily on library materials thus increasing the heavy wear and tear. Added to this are the shortages and decline in book budgets in the libraries and the high book prices in Africa. The consequence of this heavy use is that most libraries are left with a lot of damaged books in need of conservation and preservation. A joint effort of library personnel and patrons is required to stem this dangerous trend.

Patrons should realise that library materials need to be handled skillfully, not used or abused until they are worn out and then discarded and replaced, since replacement may not be possible. Library management should educate both patrons and personnel and make them conversant with the basic dos and don'ts of handling library materials.

Most libraries engage in interlibrary lending (ILL). This requires handling and transportation. In view of the rigours to which books are subjected in the ILL process, the respondents were asked the packaging methods used in their ILLs. Libraries elsewhere in the world use styrofoam popcorn, rolled newspapers or tight-fitting packages. The methods used by responding libraries include hand delivery and brown paper wrappings. As for styrofoam popcorn, the analysed data reveal that it is most likely that this seems exotic to the libraries. The method most of the libraries use is brown paper wrappings which 10 or 37% use, while eight (29.6%) use tight-fitting packages like envelopes and cartons. An almost equal number of six (22.2%) use hand delivery.

TABLE 18
HANDLING AND PACKAGING OF LIBRARY MATERIALS FOR INTERLIBRARY LENDING (ILL)

N = 27	STYROFOAM POPCORN		ROLLED NEWSPAPERS/ CARDBOARD		TIGHT FITTING PACKAGES/ ENVELOPES/ SMALL CARTONS		HAND DELIVERY		BROWN PAPER WRAPPINGS	
RESPONSE	N	%	N	%	N	%	N	%	N	%
Yes	-	-	3	11.1	8	29.6	6	22.2	10	37
No	27	100	24	88.9	19	70.4	21	77.8	17	63
TOTAL	27	100	27	100	27	100	27	100	27	100

Similarly, the respondents were asked if they restrict or ban materials, if they substitute the original with a secondary carrier and if such a carrier or substitute is a photocopy, microform or CD-ROM. The answers yielded the following tabulations.

TABLE 19
HANDLING OF HIGH USE COLLECTIONS

N = 27	RESTRICT/BAN		SUBSTITUTION		PHOTOCOPY		MICROFORM		CD-ROM	
RESPONSE	N	%	N	%	N	%	N	%	N	%
Yes	25	92.6	21	77.8	22	81.5	1	3.7	-	-
No	2	7.4	6	22.2	5	18.5	26	96.3	27	100
TOTAL	27	100	27	100	27	100	27	100	27	100

A high number of 25 (92.6%) of the respondents restrict or ban materials. An almost equally high number 21 (77.8%) of the libraries make substitutes for restricted materials, since the materials cannot be permanently inaccessible to their own users and these substitutes are photocopies in 22 (81.5%) of the libraries and only in one or 3.7% of the cases is there a microform copy. CD-ROM is still a relatively new technology in Sub-Saharan Africa, being introduced commercially only in 1985. It is, therefore, not surprising that none of the libraries surveyed currently has the capability.

To restrict or ban materials because they are in heavy demand is self-defeating. Where library materials are in heavy demand and the materials are frail or fragile and conservation is not immediately possible, substitution must be made. The substitute could be of different kinds: a duplicate of a book, a photographic reprint (offset), a photocopy, or microform which could be offered so that the original can be preserved. Microfilm copy is recommended since microfilm can last many years. Microfilm readers are common in Sub-Saharan Africa. Microfilming, like photocopying, can be a source of revenue for libraries.

7.2 Photocopying

We have seen that a majority 22 or (81.5%) of the libraries substitute photocopies of restricted materials. The implication is that a lot of photocopying is done in the libraries. It is also possible that a lot of photocopying of library materials for outsiders and for research is done for a fee.

There are risks in photocopying which is stressful to books, and this operation must be controlled and handled with care. During photocopying care must be taken to avoid damage by the copiers, or rough handling, especially in the copying of pages from very large volumes. Care also should be taken in the handling of bound volumes. Personnel should avoid undue pressure on the spine of the book in an attempt to obtain a copy that includes text close to the sewing. Library personnel are the most frequent handlers of library materials. They should receive training on the safest methods of handling and transporting library materials. Some aspects of bad handling of books include exhibitions and shipping which are not in the control of the librarian.

7.3 National Library Associations

The national library associations in African countries south of the Sahara and north of the Limpopo are in the vanguard of preservation and conservation (PAC) of library materials in their various countries. These associations do not seem to possess a coherent and articulate philosophy about PAC in their various countries. But as member states of IFLA, they have held state and national conferences on PAC. Symposia, lectures, seminars and workshops have all been held in an attempt to publicise the subject and formulate plans of action. Publications have been written by members, both academic and professionals in local and international periodicals. The only drawback they have suffered so far is their inability to make any laudable marks on the home governments to establish guiding principles for formulating and implementing national programmes for PAC. As reported by the respondents 67% of the associations fully support PAC activities while 33% have no stated position. Perhaps these associations have not yet addressed themselves to a national philosophy on PAC activities in their various countries.

7.4 Library Schools in Africa

The teaching of preservation and conservation in library schools in Africa has been more often an elective than a core course. This is not surprising since the library schools generally have the aim of producing generalists rather than narrow specialists as of now. However, the library schools have the curricula, the awareness of the need for such specialists, and the will to teach such courses. But they are hampered in the recruitment of qualified teachers. Besides there have not been employment openings in the libraries which would have spurred the production of PAC specialists. In the words of one of the respondents, PAC are taught in the library school in the country except that the graduates do not take up such appointments. Perhaps they do not find such employment. Consequently, among the respondents only five (18.5%) of the library schools teach PAC as a core course. Some 10 (37%) teach them as electives. It is assumed that the others teach PAC as part of other courses rather than that they do not teach them at all.

None of the library schools in the area surveyed is reported to be producing any graduate PAC librarians. In view of the fact that such narrow specialists do not get ready employment it would be economic suicide for librarians in Sub-Saharan Africa to graduate in a discipline for which there is no ready employment. A statistical analysis is shown in Table 20.

TABLE 20
TEACHING OF LIBRARY CONSERVATION IN LIBRARY SCHOOLS

N = 27	AS CORE COURSE		AS ELECTIVES		PRODUCTION OF GRADUATE CONSERVATION/PRESERVATION	
RESPONSE	N	%	N	%	N	%
Yes	5	18.5	10	37.0	0	0
No	22	81.5	17	63.0	27	100.0
TOTAL	27	100.0	27	100.0	27	100.0

CHAPTER VIII

PRESERVATION AND CONSERVATION

8.1 Preservation and Conservation Methods in Africa

In the march of time many methods of preservation and conservation (PAC) have been in use in Africa. We have seen that in ancient times and before the twentieth century, scrolls were kept in cylindrical boxes of wood or ivory, clay pots or pitchers. They were wrapped in cotton or linen cloth to guard against dust and humidity. Camphor, leaves of plants (herbs) and plant extracts, e.g. *Azardiracta indica L. and Dongo yaro*[1] leaves which are poisonous to insects were placed among items to be preserved to ward off insects. In old African buildings windows were small apertures in the walls. Consequently rooms were in a state of semi-darkness. These and other dark places in the interior of the buildings were used to store materials to guard against the action of heat and light. The wide verandah (balcony) around such buildings and the coolness which they engendered helped to mitigate these problems.

In colonial times when the idea of university libraries took root in Africa, the expartriate librarians constructed libraries on linear or spine forms. The buildings were linear with wide verandahs. This allowed easy cross-ventilation and use of natural light. Even so some dark areas were created for storage and for PAC. For example, at the University of Ibadan Library the area for the storage of Africana materials was made dark.

Most university libraries built in Sub-Saharan Africa before 1965 were linear or rectangular in shape. The idea of square library buildings is a recent innovation in Africa. Even this squareness of the buildings creates dark places in the interior. It was also cool for such buildings have less heat gains than rectangular ones.

New methods of building university libraries in Sub-Saharan Africa seem to be coming into vogue since the late 1980's. Perhaps this has been brought about by the world's economic depression, especially in Africa. It is called the functional library, for want of a better name, and can be a high rise or simple bungalow type. The main features are its simplicity, quandrilateral (square or rectangle) shape and the use of courtyards as voids to enhance ventilation. The buildings are wide to allow in natural light, but not too wide as to require a high amount of artificial lighting. This latter requirement seems to be in response to the unstable electricity supply in most countries. In the old square buildings one begins to feel uncomfortable within twenty minutes of power failure apart from the many dark places, which sometimes pose dangers, in the interior of such buildings. The new type of building, the functional library will rectify such faults.

8.2 Indigenous Methods

Apart from fungi, the libraries suffer inconveniences from termites, cockroaches, silverfish, firebrats, bookworms, book lice, moths, spiders, beetles, mud wasps and

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[1] I am grateful to Prof. S. L. Gill, Department of Botany, University of Benin, Benin City, Nigeria, for this information.

rodents. Reports of damage by these and fungi have been made by libraries in Ghana, Guinea, Kenya, Nigeria, Sierra Leone, Tanzania, Uganda, Zaire, Zambia and Zimbabwe.

Most of the indigenous methods for combating fungi and insects in the libraries were first formulated by expartriate librarians. The formulae were based on mercuric chloride, phenol, ogogoro, alcohol and methylated spirit. Most of the formulae originated from the University of Ibadan Library and have been adopted by others.

Respondents were asked what special PAC techniques are indigenous to their areas. The motive for the question was to get PAC techniques which can be shared by other libraries. The computed reply was as follows. Mixed methods of local and commercial preparations were being used by 70.4% or 19 libraries. The libraries using Ibadan formula only (see below) accounted for 25.9% and paper mending 3.7%.

Perhaps it is appropriate to explain the Ibadan formula for two reasons. The Ibadan University Library was one of the first in British Africa. Secondly, it had a very energetic librarian, John William Harris, who wrote on PAC in 1956 when it was less fashionable to do so. The method in use at Ibadan is as follows: a) 5 grammes of mercuric chloride, b) 60 drops or 5 grammes of creosote or phenol (or similar substitute), and c) 600 c.cm or 2 gallons (10 litres) of ogogoro (distilled gin). These were thoroughly mixed. Ogogoro was cheaper than alcohol or methylated spirit. The mixture could be applied as varnish. The formula could also be a mixture of one part by weight each of mercuric chloride, phenol and methylated spirit. The formula could be changed using multiples of the above or higher volumes, e.g. 15/17 grammes of mercuric chloride, 8/10 c.cm of creosote and 200 cm of alcohol. In Ghana, for example, the following formula was popular: 16 grammes of mercuric chloride, 0.5% (volume to volume) of beechwood creosote and one gallon (5 litres) of methylated spirit. Ibadan also used ethanol with ogogoro or methylated spirit for protection against fungi.

A word about ogogoro. This is a very popular locally distilled gin in competition with the one imported into Sub-Saharan Africa by imperial Britain. The British colonialists tried to ban it by declaring it illegal, thus, empowering the police to seize the commodity wherever it was found. The siezed ogogoro was not thrown away or destroyed. It formed a large part of a titilating hot drink for many colonial service personnel. Ogogoro also could be used as alcohol without refining or could be refined to more than 80% industrial alcohol. Thus, some of the seized ogogoro was supplied by the Ibadan police to the University of Ibadan Chemistry Department from which the Library obtained supplies for its PAC activities. This prompted *Plumbe (1964: 26)*, at the time, to say that ogogoro "possess some virtue not yet recognised by science".

The above formula has been widely used in African university libraries and in other tropical areas. Some libraries substitute shellac or methylated spirit for creosote or phenol and distilled gin (ogogoro). The mixture of ogogoro, phenol, ethanol and methylated spirit could be applied with a paint brush to inside covers, angle of cover and the body of a book around the inside edges and outside. The book should then be left to dry. For spraying shelves ethanol was mixed with ogogoro or methylated spirit. This is very effective against fungi growth. According to *Uyigue (1992)*, ethanol and phenol are toxic, causing boils on skin. Protective clothing is, therefore, essential when it is used.

It has been stated that Gamalin, a form of Gamma-BHC, is used as an insecticide against termites. Gamalin is a brand name of insecticide used in farms. Many termite control formulae have agricultural applications. For controlling termites, poisoned bait can be made from 25g paris green, 100g flour and 80g sugar. These are mixed to stiff

dough. Small lumps of the dough can be dropped into termite nests or into holes bored at their sites. This dough is highly toxic to persons and livestock. Where there is such a danger, an alternative using a mixture of flour with 50g borax and 100g sugar is as effective but less toxic to mammals. Similarly a mixture of lime and sulphur can be used to prevent termite attack. Carbolic disinfectant powder, diluted tar or tar water also are useful preventives against termites.

A mixture called gondal fluid has been found to be highly effective against termites in many parts of Africa and can be made up as follows: 100g gum, 200g asatoetida, 200g aloe and 80g castor cake. These are mixed well with boiling water. The mixture can be thickened with clay. The mixture can be applied to termite sites or routes. Gondal fluid seems to have originated from India where it might have been used on farms.

No single insecticide is a cure-all. As well as the above formulae, Insecta-lac, a commercial preparation, is being used all over Africa against cockroaches and other crawling insects. There are a host of other preparations by petroleum companies, going by different brand names but which are essentially the same in their effects on insects. Dieldrex 15, DDT and Dieldrin dust or 10% sulphuric acid in butanol can be applied to shelves, window frames and sills. In some of the libraries book shelves are sprayed with Dieldrin as protection against insects which enter the library daily in large numbers especially during the rainy season. Since electric lights attract insects in droves, electric lights in and around libraries should be protected.

CHAPTER IX

REMEDY MEASURES

9.1 Deacidification

The degradation of cellulose is caused by the presence of acid impurities in paper. As a result paper becomes brittle. Most paper deteriorates with time but acidity is the major cause of the deterioration. It has been estimated that the loss through deterioration of materials by acidity is much more than the damage caused by fires, floods, and other agents combined. Acidity in paper is caused by the use of impure cellulose, rosin alum sizing, residual chemicals left in paper by improper manufacture, environmental conditions or use of acidic links.

Deacidification is a process by which acid in paper is removed. In spite of certain shortcomings, the most satisfactory method of deacidification is still that devised by *Barrow (1965)*. This method involves the immersion of the paper in a saturated solution of calcium hydroxide (lime water) which neutralises the acid. The paper is then immersed in a diluted (about 0.15%) solution of calcium bicarbonate, which is prepared by passing carbon dioxide gas in water. This removes any excess calcium hydroxide from the paper. For paper written in ink which is soluble in water a non-aqueous method of deacidification must be used. According to *Kathpalia (1975: 268-269)* printed materials could be deacidified with a non-aqueous solution (0.2%) of barium hydroxide. Amonia could also be used even with fumigation equipment. The use of amonia in a gaseous form has a transitory effect as a deacidification process. But it can be repeated without any harm to the printed materials. This process could be used on a mass scale and in situ as with the fumigation of materials with methyl oxide gas or with methyl bromide. This process could save labour, time and expense in preserving materials for years to come. The benefit would be infinite, keeping in mind the number of printed materials being produced daily and the need to conserve them.

Similarly, *Dr. Richard D. Smith* of Wei T'o Associates, U.S.A., has developed a process for mass deacidification of printed materials by using liquid gas formation in a pressure chamber as well as a spray technique with magnesium methyl oxide. Through this process about 150 books or more can be deacidified in an eight hour day at very low cost per book. Effective deacidification treatment doubles or triples the life of paper. African university libraries could profit significantly if they learned to use these processes.

In Africa south of the Sahara and north of the Limpopo deacidification is hardly known in university libraries. None of the 27 (100%) respondents have a deacidification programme. The only deacidification programme I am aware of is not in a university library, but in the National Archives of Nigeria to which the University of Ibadan Library has access. The method of deacidifcation employed there involves the use of magnesium bicarbonate *(Alegbeleye 1988b: 197)*. A solution of magnesium carbonate ($MgCO_3$) is made up by adding 1.5g of $MgCO_3$ to one litre of distilled water. Carbon dioxide is then bubbled through the solution to produce a solution of magnesium bicarbonate, ($MgCO_3 + CO_2 + H_2O = Mg(HCO_3C_2)$. It deacidifies by reacting with sulphuric acid to produce magnesium sulphate plus water and carbon dioxide ($(MgCHO_3)_2 + H_2SO_4 = MgSO_4 + 2H_2O + 2CO_2$). The residual buffer is magnesium carbonate. This buffer reacts with sulphuric acid to produce magnesium sulphate ($MgCO_3 + H_2SO_4 = MgSO_4 + H_2O + CO_2$).

Most of the countries in which the university libraries are situated have national archives with which they could cooperate in a joint deacdification programme. In addition there are Chemistry Departments in these universities which could give insight into the problems. The university libraries, therefore, should cooperate in these matters with the science faculty in their universities.

9.2 Restoration

Damaged library materials need to be restored to prolong their usage. Restoration is the taking of corrective measures to strengthen weakened and brittle documents. A large number of materials have been so badly damaged that they cannot be used by patrons. Restoration would then be one of the means to impart strength.

It is reported by the respondents that between .01% and 6.78% of the holdings of Sub-Saharan African first generation academic libraries are in poor condition and in need of repairs. These are high figures. In Balme Library, University of Ghana, one of the first generation of academic libraries in Africa, .01% of the collection is in poor state. In terms of volumes this percentage translates into 4,000 damaged volumes in need of repair and restoration. It is estimated that the percentage of damaged materials in the newer academic libraries established since 1980 is 10-15%, but may be higher in some cases as these libraries tend to purchase cheap paperback editions owing to inadequate funds and the need to meet increasing demands for more titles and multiple copies. It is calculated that an average of 4% of their entire collections are in bad shape.

9.3 Principles of Restoration

The techniques of restoration are universal regardless of climatic conditions. They are easily adapted to local conditions once the basic elements are grasped. Some basic restoration operations done on library materials are the removal of surface dirt, stains, lamination, encapsulation and binding. An examination of the material would indicate its nature (parchment, paper), the physical damage (by sunlight, insects), whether the material is acidic or the ink soluble in water. Once the problems are assessed, taking good care, the material is cleaned up by removing the surface dirt. General cleaning of the materials makes them neat for patrons. It also helps cut down the cost of repair.

Most of the respondents, 88.9% use hand dusters to dust and clean the materials. The other popular methods are damp cloth 7.4% and the use of detergent, presumably with dusters or cloth 3.7%. This method is not only laborious, but also exposes the materials to the danger of physical damage by the cleaner. The computed frequency is shown in Table 21.

TABLE 21
REMOVAL OF SURFACE DIRT AND STAINS

N = 27	DUSTING		DAMP CLOTH		DETERGENT	
RESPONSE	N	%	N	%	N	%
Yes	24	88.9	2	7.4	1	3.7
No	3	11.1	25	92.6	26	96.3
TOTAL	27	100.0	27	100.0	27	100.0

Modern methods of dusting materials involve the use of vacuum cleaners and of a blow gun fitted to a compressor with a pressure control which fires a blast of air directed along the sides and edges of the materials to blow off the dust without damaging the material. With controlled blasts even brittle documents could be safely cleaned. Vacuum cleaners should be used on floors to prevent dust being dispersed rather than removing them. The blow gun method is efficient, speedy and avoids damage to the materials. But the equipment is expensive to install and requires spare parts, which may not be available, and technical expertise to be effective.

Dirty marks and stains on documents could be removed in some cases by the use of a soft eraser or powdered art gum such as draft clean powder. The procedure is as follows: sprinkle some powder over the dirty areas on the material and rub with finger tips. If this method is unsuccessful, it may be necessary to wash the paper.

9.4 Washing

According to *Unomah (1988: 14)* washing of documents helps to reduce water stains and permit the removal of creases or wrinkles and other distortions. It also helps to increase the mechanical strength of dry and brittle paper. Some creases or wrinkles can be ironed out with a warm iron over a damp cloth placed on the material. Simple washing in clean, preferably distilled water, helps to remove dark soluble matter and some free acid from the material. This method was not mentioned by any of the respondents. However, it is useful in PAC activities. Some of the equipment for washing, like enamel trays, may be available locally, but thermostatically controlled stainless sinks and detergents like lissapoln will have to be imported with resultant delays and high costs, if funds are available.

9.5 Lamination

In the protection of library materials the methods that have withstood the test of time are traditional ones like the Florentine technique and the lamination process. While the Florentine technique appears far-fetched in the African context, the lamination process will be discussed more extensively. Materials which are fragile and brittle due to degradation need lamination. Lamination is the process of using cellulose acetate to reinforce brittle or deacidified library materials. There are several reasons why lamination is necessary as a means of restoration: 1) to restore documents which may be involved in fire, flood, war, etc., 2) to impart mechanical strength or durability, and 3) to

restore an individual document which may have been damaged in one way or the other. Two methods of lamination are now in common use: the orthodox or classical method and the synthetic or modern method.

9.6 Orthodox Method

The orthodox method involves the bonding of damaged paper between the reinforcing sheets of cellulose acetate. It is sometimes called "cold" lamination. The process is simple. The material is first covered on one side with a film of cellulose acetate, over which is placed a sheet of tissue paper. The surface is then rubbed over with a swab of cotton wool moistened with acetone, using slight manual pressure. The acetone dissolves the cellulose acetate film which causes the tissue paper to adhere to the document. However, acetone is toxic and explosive and must be handled with care.

9.7 Synthetic Method

Synthetic or "hot" lamination involves sandwiching the material between two sheets of a suitable transparent supporting material, e.g. cellulose acetate, plastic film or cellulose triacetate. Lamination is especially advantageous in Africa because when a library cannot afford to buy complicated and expensive equipment, it would find simple remedial measures just as effective. The simple measures include the above and the use of cellulose acetate with manual pressure or applying pressure with an electrically heated hand iron or photographic drymount press. The advantage of lamination is principally the increased durability of the materials by imparting mechanical strength to them.

When asked if they laminate or possess lamination equipment, 24 libraries or 88.9% replied in the negative while three libraries or 11.1% so affirmed. None stated the brand of equipment that they possess, but one library stated the equipment to be an adhesive dry mounting machine.

9.8 Bindery

African librarians may not be aware of the extent of paper deterioration in their libraries, but they are unwittingly presiding over bibliographic resources that are gradually but inexorably deteriorating. African academic libraries have binderies where manual procedures are adopted. Most of the work done is the rebinding of torn and worn-out library materials (85%), supplemented by student projects (10%) and assistance from others in the university community (5%).

Book binding developed as an ancient handicraft. *Banister (1975: 6)* dated it back to the 4th century A.D. There was no organised library binding before 1900. But hand sewing of library materials has been in existence for a long time. Book binding as a practice of restoring damaged library materials has a long history.

All the libraries surveyed possess binderies (100%). As to whether the binderies are part of the libraries or autonomous, 85.2% or 23 libraries responded that the binderies are part of the library, while four or 14.8% of the binderies claim to be autonomous. The manual procedure of hand binding or sewing is the most popular method used in repairing library materials. This procedure is very slow and engenders low productivity in the absence of machine binding or sewing which are in use in 9 or 18 libraries, 33.3% or 66.7% respectively. The results are tabulated in Table 22.

TABLE 22
BINDERY AND PROCESSES

N = 27	POSSESS A BINDERY		PART OF LIBRARY		HAND-BINDING/ SEWING		MACHINE BINDING		MACHINE SEWING	
RESPONSE	N	%	N	%	N	%	N	%	N	%
Yes	27	100	23	85.2	24	88.9	9	33.3	18	66.7
No	-	-	4	14.8	3	11.1	18	66.7	9	33.3
TOTAL	27	100	27	100	27	100	27	100	27	100

Some of the libraries have between one and 18 looms and stitching frames while 14 or (51.9%) of the libraries have none. The break down of the remaining 13 or 48.1% of the libraries is as follows: five libraries have book presses, two libraries have sophisticated bindery equipment, one has a stitching machine and five have other types of unspecified bindery machines. A situation in which 14 of the libraries have no hand or powered looms indicates that the binderies would be unable to cope with the restoration of damaged library materials in their respective libraries.

Of the other supporting facilities which can aid the efficiency of the bindery services, all the libraries surveyed possess photocopiers and duplicating systems, but only 30% or eight libraries have electronic scanners.

Repairs of damaged library materials by the in-house bindery often saves libraries a lot of money as well as earning some money from outside jobs. In-house repairs also ensure that the library has complete control over its bibliographic resources. Libraries should strengthen their binderies, no matter how small, as a permanent solution to the problem of the preservation of damaged library materials. Binderies also can be a goldmine for the libraries if efficiently managed.

9.9 Books Requiring Binding and Restoration

That library materials are gradually deteriorating before our very eyes is not in doubt. What probably is not known to many persons is the rate of deterioration. As far back as 1907, *Davenport (1907: 82)* wrote that "there is no doubt that majority of our modern books will not be in readable condition in about a hundred years' time from the date of their publishing ..." *Barrow (1959)* found in a survey of the deterioration of non-fiction books in the U.S.A. that most of the books will soon be in an unusable condition. Unfortunately not many studies have been carried out in Africa to ascertain the deterioration rate of library collections in a tropical environment.

An attempt was made to estimate the rate of deterioration and the numbers of books currently requiring restoration in the 27 libraries surveyed. It is noted that Copperbelt University, Kitwe, Zambia has the lowest reported collection at 17,000 volumes. At the other end is the University of Ibadan with over 675,000 volumes. In between the two extremes are various total collections of 75,000 volumes for Edo State University, Ekpoma, Nigeria, 117,000 volumes for the University of Benin, Nigeria, 165,000 volumes for the National University of Lesotho, and 320,000 volumes for Ahmadu Bello University, Zaria, Nigeria.

Ifidon (1990: 16) in his study of collection development in 18 African universities, most of which are also the subject of this study, found that the 18 universities have a total collection of 4,134,650 volumes. The present survey of 27 African universities reveals that their collections have grown to 6,822,179 volumes in 1992. It has been noted that 4% of the entire collections of the 27 African university libraries are in various stages of deterioration. This percentage translates into 272,887 volumes that need restoration. At an average cost of $3.50 per volume for repairing and restoring them to useful life, the total cost would be $955,104. This is a huge amount for the African university libraries. Even most of the libraries would not be able to afford the average cost of $35,374 for each library.

9.10 Adhesives in Use in Bindery

The type of adhesive in use in the binderies is very important for the longevity of the materials. Acidic glues would cause physical and chemical decay in no time. Bearing this in mind, the respondents were asked the names of the adhesives they use in binding library materials and whether the adhesives were acid-free. The various brands of adhesive in use by the respondents can be grouped as follow: a) Polyvinyl Acetate (PVC), A22B, Duro, b) Pona cold glue, c) Hot melt/Animal glue, and d) Henkel A22B. Some of the binderies use a mixed bag of adhesives. It seems that they tend to buy whatever is available at any given time. Sixteen or 59.3% of the libraries use the adhesives in groups (a), four or 14.8% use those in group (a) and (b). An equal number use those in group (a) and (c), while only one or 3.7% of the libraries use those grouped in (d) and two or 7.4% of the libraries use all the brands grouped as (a) - (d) above.

Are these adhesives acid-free? The frequency responses are that eight or 29.6% of the libraries were positive that the adhesives they use are acid-free, while 19 or 70.4% of the libraries were negative in their responses.

From the above analysis some four libraries use hot melts or animal glue in their binderies. It is suggested that animal glues should not be used for library binding. Book adhesive bond with animal glues break up easily in circulation. Hot melts are a formulation of wax resin and polymers. They are 100% thermoplastics. Hot melts depend on plasticizers for their flexibility. As these plasticizers dry out with time the adhesive toughens and loses much of its initial flexibility. They are not recommended for library binding. According to *Werner (1964: 29)*, PVA which is a water-based synthetic resin emulsion is currently the material for adhesive binding. It is acid-free and has excellent thermoplastic and aging qualities.

9.11 Trained Personnel

For conservation, preservation and restoration to be effective in African academic libraries, there must be trained personnel with the requisite technical expertise. Libraries must embark on progressive staff development and library education for all levels of staff. In African countries, as in most developing countries, technical expertise is in short supply in library services, as well as in many areas of science and technology. Library binding requires both skills and technology. According to *Ojo-Igbinoba (1992: 12)* all large libraries possessing binderies should institute an apprentiseship system to develop artisan binders. He adds that a system of an apprenticeship is a fact of life in most developing as well as developed countries. The apprenticeship system could be used to train skilled binders to deal with the typical conservation problems of a university library.

For example, the Milton S. Eisenhower Library of the John Hopkins University, U.S.A. already has such a system in place. The City and Guild of London Institute has a syllabus for an apprentice training system which can be modified to suit institutional preferences.

If getting library materials and making them available to readers is the core of librarianship, it should also be paramount to conserve materials. *Bansa (1983: 113)* states that if there are needs for acquisition librarians, reference librarians, and readers' services librarians, then there should be conservation, preservation and restoration librarians as well. *Barker (1981: 194)* adds that some libraries are already expending as much money on conservation work as they spend on acquisitions and on readers' services. Conservation work should not be treated as a peripheral service, but as an integral part of library activity requiring the services of conservation librarians. It is just as important as acquisitions, readers' services or cataloguing.

CHAPTER X

CONCLUSIONS AND SUGGESTIONS

10.1 Conclusions

Conservation as a practice of restoring damaged library materials has a long history. Preservation is the art of anticipating and preventing damage to library materials and includes mending and binding, addition of duplicate copies, reprints, microfilming and photocopying on acid-free paper. Library materials with known enduring value at the time of their publication should be produced on permanent paper. All others should be produced on alkaline paper. From about 1850 paper was made primarily from ground wood and sized with alum and rosin. Papers containing these materials are not only highly acidic but they are also chemically self-destructive. As a result, African university libraries are full of a large number of materials that are deteriorating and brittle.

As stated by the U.S. *President George Bush (Wayne 1992: 136)*:

> ...a significant portion of our intellectual and cultural legacy is rapidly disintegrating in libraries, archives, museums, historical societies and other repositories across the country. Millions of books, serials, manuscripts and documents are decaying because of the acidic content of their paper.

This speech of *President Bush* exemplifies the danger facing the cultural heritage of mankind of which the African university library system is a part.

According to the *Library of Congress Information Bulletin (Wayne: 1992)*, the preservation options for dealing with acidic paper are environmental control, deacidification and reformatting. In addition a controlled environment with appropriate levels of temperature and relative humidity can slow the rate of deterioration. Deacidification neutralises acid in the paper, introduces an alkaline reserve that protects the paper from subsequent acid attack, and this can extend the usable life of paper three to five times. Reformatting brittle paper, either through microfilming or preservation photocopying, preserves the intellectual content of materials whose usable life is over.

Library resources represent works of intellectual creation which provide relevant information for decision-making and normal development. Any threat to them is a threat to man's historical records, thoughts and linkage with the past. It is, therefore, necessary to conserve these materials for our benefit and those of posterity. Unfortunately, it would appear that in Sub-Saharan Africa not much attention is being given to the conservation of library materials compared with the attention given to collection development and organisation of library materials. Even in library schools in Sub-Saharan Africa the teaching of PAC is of recent emphasis. In such a situation, one is hard-put to think of usable library collections remaining in the distant future.

10.2 Suggestions

The following suggestions are germane to the subject. African governments should enact laws to increase the use of permanent paper as a part of a national policy. Each country with a paper mill should set up a national committee to ensure that the paper mills implement a national policy on acid-free or alkaline papers. Some

impediments to the realisation of this goal have been canvassed. One is the higher cost of acid-free papers relative to alkaline and acidic papers. The other is the difficulty in determining at its creation whether a material has enduring value. Since alkaline papers or acid-free papers are generally no more expensive than their acidic equivalents, acid-free or alkaline papers should be used for library materials.

Governmental and non-governmental organisations and agencies should produce their records, books and publications of enduring value on acid-free paper. Publishers, whether Africans or non-Africans publishing or producing their books for use in Africa should make such publications on acid-free paper. It is also suggested that state and local governments as well as public and private publishers should produce their publications on alkaline or acid-free paper. Commercial printing contracts should specify alkaline or acid-free paper. National libraries in African countries should work with their respective library associations and IFLA to advocate the use of permanent/alkaline paper.

In fact, as related by *Wysocki (1986: 313)*, the International Conference of Preservation of Library Materials recommends that IFLA (of which nearly all African countries' library associations are members) encouraged member associations to urge national policy-making bodies to establish guiding principles for formulating and implementing national programmes for preservation and conservation of library materials. Such a council also should cooperate with the various national standards organisations, the national archives and the national libraries in Africa. It is suggested that librarians spearhead this proposal. The various national library associations should establish a section on preservation and conservation. The library schools should be pressured by librarians for core courses and continuing education in the area of PAC.

African countries can benefit from various bilateral programmes which provide fellowships and consultants. Arrangements can be made with the embassies of countries concerned. Furthermore, UNESCO aids its member states through the dispatch of experts or consultants, as well as the provision of fellowships and of technical and scientific equipment at the request of the government concerned.

The paper mills in Africa should be encouraged, if possible by obligatory legislation, to produce not only acid-free paper for book publishing, but to add insecticides and fungicides to their production process. This suggestion is nothing new. For example, in the third century A.D. when Huang-Nieh, an insecticide manufactured from the seed of Anuer Corktree was in use in China, manufacturers were compelled by law to add this in the process of paper manufacture.

In the building of new libraries in Sub-Saharan Africa, the control of heat and light should not be left alone in the hands of the architect and the engineer, especially when the architect is in a position to impose features that please his aesthetic sense but are unfunctional in the library process. The use of several pack units rather than one massive central airconditioner is suggested. Where airconditioning is not feasible for lack of money or infrastructure, the use of linear buildings or a complex of linear building in quandrangles with courtyards which act as voids and with wide verandahs around them will keep the interior cool. Fans should be used as a supplement where possible to counteract the effect of humidity. There is a need for more studies on the effect of airconditioning in tropical climates, especially in Africa, in which deserts occur north and south of the Equator occasioning high heat, dust and high relative humidity. Central airconditioners have generally performed poorly in tropical African countries.

Many of the old academic libraries in Africa have basements. Basements generally tend to be damp, musty, liable to biological infestation and flooding. For these reasons basements are not advisable for libraries in the tropics unless they can afford dehumidifiers.

Good housekeeping practices of cleanliness are vital in PAC activities. Conservtion practices should start with sound construction practices in library buildings. Damp areas like toilet facilities which are breeding grounds for insects and rodents should be sited away from storage areas. Materials used in construction should afford maximum protection against insects, fungi, heat, light, humidity, fire and flood which cause damage to library materials.

There is a lack of technical expertise all round. Apart from lack of technical expertise librarians are not well informed about the preservation and repair of library materials. Conservation and preservation of library materials are hardly taught as core courses in the library schools. The emphasis on PAC activities which has rubbed off onto the library schools is of recent origin. Consequently, many head librarians in Sub-Saharan Africa do not have background in PAC activities. Hence, the need for continuing education for all, especially those in leadership positions in African librarianship. Library schools should institute courses in the methods of conservation, preservation and restoration of library materials. Lack of technical expertise and the use of outdated techniques can do more harm than good. Even for trained staff, means must be found to maintain contacts and exchange views with colleagues abroad so as to keep abreast of the latest developments. African librarians seem to be in a bind. There are no funds for international exchanges and local opportunities are very much truncated.

In view of the high cost of the equipment needed for conservation and preservation work, the weak financial base and lack of technical expertise in most of the libraries in Sub-Saharan Africa and the paucity of commercial dealers, it is suggested that libraries join in cooperative ventures. Such cooperative ventures will pay off in no time through sharing the cost of the facilities, expensive equipment and staff training.

In this regard assistance from governments will be needed in the form of funding and enabling legislation to set up a Council of Library Resources for each country, not only to foster and coordinate PAC and related activities but also to: 1) organise conferences, seminars and workshops in partnership with each national library association, 2) formulate policies, 3) publicise preservation and conservation of library materials in order to raise awareness about such practices, and 4) promote research on methods and materials of conservation and preservation. The government must provide such councils with staff and adequate funds to ensure that they accomplish their purpose of preserving and carrying out their programmes of research, publication and exhibition.

Finally, it is suggested that libraries should microfilm part of their collections so that the originals can be preserved from frequent handling and the consequent rough use. Microfilm copies can last many years. It is through efforts such as those suggested that the collections of African academic libraries can be permanently preserved.

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APPENDICES

APPENDIX A
LIST OF UNIVERSITY LIBRARIES TO WHICH QUESTIONNAIRES WERE SENT

Those designated with an * replied to the questionnaire.

BOTSWANA

*The University Librarian
University of Botswana
Private Bag 0022
Gaborone, Botswana

BURKINA FASO

Bibliothecaire
Université d'Ouagadougou
BP 7021
Ouagadougou, Burkina Faso

CAMEROUN

*Bibliotheque
Université de Yaounde
PO Box 337
Yaounde, Cameroun

CHAD

Bibliothecaire
Université du Tchad
BP 1117
N'Djamena, Chad

CONGO

*Bibliotheque Universitaire
(Centrale)
Université Marien Ngouabi
BP 69
Brazzaville, Congo

COTE D'IVOIRE

Bibliotheque
Université d'Abidjan
BP V34
Abidjan, Cote d'Ivoire

GABON

Bibliothecaire
Université Omar Bongo
BP 13131
Libreville, Gabon

GHANA

*The University Librarian
University of Cape Coast
University Post Office
Cape Coast, Ghana

*The University Librarian
University of Ghana
PO Box 25
Legon, Ghana

*The University Librarian
University of Science &
Technology
PMB
Kumasi, Ghana

KENYA

*The University Librarian
Egerton University
PO Box 536
Njoro, Kenya

*The University Librarian
Kenyatta University
PO Box 43844
Nairobi, Kenya

*The University Librarian
Moi University
PO Box 3900
Eldoret, Kenya

*The University Librarian
University of Nairobi
PO Box 30197
Nairobi, Kenya

LESOTHO

*The University Librarian
National University of
Lesotho
PO Roma 180, Lesotho

LIBERIA

The University Librarian
Cuttington University
PO Box 277
Monrovia, Liberia

The University Librarian
University of Liberia
PO Box 9020
Monrovia, Liberia

MALAWI

*The University Librarian
University of Malawi
PO Box 278
Zomba, Malawi

NIGER

Chief de la Bibliotheque
Universitaire
Université de Niamey
BP 238
Niamey, Niger

NIGERIA

*The University Librarian
Ahmadu Bello University
Zaria, Nigeria

*The University Librarian
Edo State University
Ekpoma, Edo State, Nigeria

*The University Librarian
University of Benin
Benin City, Edo State
Nigeria

*The University Librarian
University of Ibadan
Ibadan, Nigeria

*The University Librarian
University of Ilorin
Ilorin, Nigeria

*The University Librarian
University of Jos
Jos, Nigeria

*The University Librarian
University of Maiduguri
Maiduguri, Nigeria

The University Librarian
Uthman Dan Fodio
University
Sokoto, Nigeria

RWANDA

*Director de Bibliotheque
Université National du
Rwanda
BP 117
Butare, Rwanda

SENEGAL

Bibliothecaire
Université de Dakar
Dakar-Fann, Sénégal

SIERRA LEONE

The University Librarian
Fourah Bay College
PO Box 87
Freetown, Sierra Leone

The University Librarian
University of Sierra Leone
PMB
Freetown, Sierra Leone

SWAZILAND

*The University Librarian
University of Swaziland
Private Bag 4
Kwaluseni, Swaziland

TANZANIA

*University Librarian
University of Dar es Salaam
PO Box 35091
Dar es Salaam, Tanzania

The University Librarian
Sokoine University of
Agriculture
PO Box 3000
Morogoro, Tanzania

TOGO

Bibliothecaire
Université du Bénin
BP 1515
Lome, Togo

UGANDA

*The Univeristy Librarian
Makerere University
PO Box 7062
Kampala, Uganda

ZAIRE

Bibliotheque
Université Nationale du
Zaire
Campus de Kisingani
Kisingani, Zaire

Bibliotheque
Université National du Zaire
Campus de Kinshasa
BP 127
Kinshasa, Zaire

Bibliotheque
Université National du Zaire
Campus de Lubumbashi
Lubumbashi, Zaire

ZAMBIA

*The University Librarian
Copperbelt University
PO Box 21692
Kitwe, Zambia

*University Librarian
University of Zambia
PO Box 32379
Lusaka, Zambia

ZIMBABWE

*The University Librarian
University of Zimbabwe
PO Box MP 167
Mount Pleasant
Harare, Zimbabwe

APPENDIX B

PRACTICE OF CONSERVATION OF LIBRARY MATERIALS IN AFRICA: A QUESTIONNAIRE

*The information on the questionnaire is listed below. The questionnaire that was sent provided more space for replies.

A. GENERAL

1. Name of Library
2. Year founded
3. Number of Teaching Staff
4. Number of Students
   (a) Post graduates
   (b) Undergraduates
   (c) Others (Please Specify)
5. Hours of Opening
   Monday-Friday
   Saturday
   Sunday

B. PRESENT STOCK/HOLDING STATEMENT

1. Number of Books
   (a) Titles
   (b) Volumes
2. Number of Journals
   (a) Bound volumes
   (b) Current titles
3. Number of Theses
   (a) Titles
   (b) Volumes
4. Others (Please Specify)

C. STOCK SPECIALISATION

State areas of strength of the collection

D. WHICH REPROGRAPHY EQUIPMENT DO YOU HAVE

(a) Microfilm equipment?
(b) Photocopying equipment?
(c) Others (Please Specify)

E. SUPPORT SERVICES

1. Is there a Bindery? (Tick as appropriate) Yes .... No ....
2. If yes, is it part of the library? Yes .... No ....
3. If no, is it an autonomous unit? Yes .... No ....
4. If no, please elaborate.
5. What other mechanical devices do you have to assist you in the conservation of books and journals?
6. What other support services do you have?
7. How do you bind library materials (Tick as appropriate)
   (a) Use of machine binding/sewing? ....
   (b) Use of hand binding/sewing? ....

8. How many looms and stitching frames do you have?
9. Name the kinds of adhesives you use in binding library materials.
10. Are these adhesives acid-free? (Tick as appropriate) Yes .... No .... Do not know ....
11. Do you use
    (a) Animal glues? Yes .... No ....
    (b) Hot melts? Yes .... No ....
    (c) PVA (Polyvinyl Acetate)? Yes .... No ....

F. INTER LIBRARY LOANS

1. Number of library materials loaned in: 1985/86 .... 1986/87 .... 1987/88 .... 1988/89 .... 1989/90 ....
2. How are these normally packaged? (Tick as appropriate)
    (a) Use of styrofoam popcorn?
    (b) Use of rolled newspapers?
    (c) Use of special tight fitting packages?
    (d) Others (Please Specify)
3. Handling of high use of collection:
    (a) Do you restrict or ban material in poor condition? Yes .... No ....
    (b) Do you substitute the original with a secondary carrier? Yes .... No ....
    (c) Is the substitute/secondary carrier a:
        (i) Photocopy? Yes .... No ....
        (ii) Microform copies? Yes .... No ....
        (iii) CD-ROM? Yes .... No ....
        (iv) Other? (Please Specify)

G. CLIMATE

1. Climate condition; kindly supply the following with regards to your area/town/country:
    (a) Mean annual temperature ....°F
    (b) Lowest annual temperature ....°F
    (c) Highest annual temperature ....°F
    (d) Annual temperature range ....°F
2. Daily variation of temperature:
    (a) Minimum temperature ....°F
    (b) Maximum temperature ....°F
3. Humidity:
    (a) Mean humidity at 600 hours ....% and 1500 hours ....%
    (b) Mean annual relative humidity at 600 hours ....% and 1500 hours ....%
4. Daily ranges in relative humidity at 600 hours ....% and 1500 hours ....%
5. Mean duration of sunlight hours per day ....hours

H. NATURAL DISASTERS

1. What precautions do you have against fire outbreak? (Tick Yes/No)
    (a) Fire extinguishers
    (b) Fire Dept.
    (c) Prohibition of naked light
    (d) Smoking
    (e) Automatic sprinkler system
    (f) Total flooding with carbondioxide Co_2
    (g) Total flooding with high expansion foam
    (h) Properly engineered hydrogenated agent system
    (i) Use of conduct wiring
    (j) Use of fire resistant materials in library building
    (k) Use of steel doors

(l) Use of steel shelves
(m) Use of fibre glass and asbestos in building

2. Capacity in fire extinguishment? Do library personnel have:
   (a) Training in fire extinguishment? Yes .... No ....
   (b) Experience in fire extinguishment? Yes .... No ....
   (c) Fire drills occasionally? Yes .... No ....
   (d) Is there any fire brigade near the library? Yes .... No ....
3. Detection Devices: What disaster detection do you have?
   (a) Smoke detectors? Yes .... No ....
   (b) Fire detectors? Yes .... No ....
   (c) Human security guards? Yes .... No ....
   (d) Other? (Please Sepecify)

I. FLOOD

1. What precautions do you have against flood from rain water or storm or other?
2. Any storm drains round the library building? Yes .... No ....
3. Is the roof of the library building:
   (a) Flat? Yes .... No ....
   (b) Ridged or heaped? Yes .... No ....
4. Does the library own or have access to equipment for treating books and papers damaged by water?
   (a) Fans? Yes .... No ....
   (b) Cold storage? Yes .... No ....
   (c) Freeze-drying facilities? Yes .... No ....
   (d) Dehumidifiers? Yes .... No ....
   (e) Vacuum drying? Yes .... No ....
   (f) Humidifiers? Yes .... No ....
   (g) Other (Please Specify)
5. Do you have the requisite skills in paper repair work or conservation in the event of a fire or flood disaster and post-disaster recovery operation? Yes .... No .... Please explain.

J. EARTHQUAKES

1. Does the country lie in the zone prone to earthquakes? Yes .... No ....
2. Is the library sited in an area prone to earthquakes? Yes .... No ....
3. If yes, what precautions have been taken in erecting the library building(s)?

K. RIOTS/WAR

Has your area ever been engulfed in riots or war? Yes .... No ....
If yes, what was the effect on the library? (Please elaborate)

L. CONSERVATION

1. Do you practice deacidification? Yes .... No ....
2. How do you deacidify printed materials in your library?
3. Extent of Current Damage (Please express the current damage which requires conservation/preservation as a % of the total collection.)

M. ENVIRONMENTAL PROBLEMS

1. What measures do you take against insect pests?
2. Fungi infestation/preservation?
3. Rodents?

4. Do you have:
   (a) Sterilization equipment? Yes .... No ....
   (b) Fumigation equipment? Yes .... No ....

N. LIBRARY BUILDING: PHOTO CHEMICAL EFFECTS

1. What measures have been taken in the library building(s) against
   (a) Sunlight
   (b) Heat
   (c) Humidity
2. How do you handle atmosphere pollution?
3. What tropical building devices are incorporated in the library building(s)?
4. How do you handle dust problems in the library?
   (a) Do you have dust blowing guns? Yes .... No ....
5. Any infrastructural problems? (Please name them.)
6. Any problem with technicians to service/repair your equipment? Yes .... No ....
7. If yes, please elaborate.
8. Does the library suffer from blackout/power cut/erratic power supply? Yes .... No ....
9. Has the library standby generators which supply power in time of power cuts, etc? Yes .... No ....

O. RESTORATION

1. How do you remove surface dirts, stains from library materials?
2. Do you laminate or have lamination equipment? Yes ....No ....
3. If yes, what is the equipment?
4. Do you encapsulate library materials? Yes .... No ....
5. If yes, what equipment do you use?
6. What special conservation/preservation techniques are indigenous to your area/country? (Please elaborate)

P. CLEANLINESS

How often do you do general cleaning/washing of the library floors including stack and storage areas?

Q. COOPERATIVE CONSERVATION

1. Are you in any cooperative venture with any other library for conservation/preservation?
   Yes .... No ....
2. If yes, what is the extent of the cooperation?

R. PAPER MILLS

1. Is there any paper mill in the country? Yes .... No ....
2. Does your library insist on book suppliers supplying only books printed on acid-free papers?
   Yes .... No ....
3. If yes, how successful has been your insistence?

S. NATIONAL ASSOCIATION

1. What is the position of the National Library Association in this matter of conservation of library materials?

T. LIBRARY SCHOOLS

1. Does/do the library school(s) in the country teach library conservation as a core or elective course?
   (a) Core: Yes .... No ....
   (b) Elective: Yes .... No ....
2. Does it or have they produced any graduate conservation/preservation librarian? Yes .... No ....
3. If yes, how many to the end 1989/90 academic session?

U. COMMENTS

Please feel free to comment and make any other recommendation you think will assist us in this project. (Use additional sheets if necessary).

*V. **Thank you for your assistance and cooperation. We shall continue to count on your support.***

Please mail the duly completed questionnaire to:

M. E. Ojo-Igbinoba
Edo State University Library
P. M. B. 14
Ekpoma, Nigeria
West Africa

Monographs on Africana Librarianship

No. 1 Sam E. Ifidon. **Collection Development in African University Libraries - Challenges and Frustrations.** 1990. $4

No. 2 Ken M. C. Nweke. **Information-seeking and Use by Human and Veterinary Medical Scientists (HVMS) in Africa: Case Study from Borno State, Nigeria.** 1992. $5

No. 3 M. E. Ojo-Igbinoba. **The Practice of Conservation of Library Materials in Sub-Saharan Africa.** 1993. $7

No. 4 A. Anaba Alemna. **Oral Literature in African Libraries: Implications for Ghana.** 1993. $6

In preparation

No. 5 S. I. D. Khamadi. **The Role of Library Education in Agricultural Production in East African Countries.**

Monographs are available free of charge to libraries and librarians in Africa. Requests for monographs should be sent to: Nancy J. Schmidt, African Studies Program, 221 Woodburn Hall, Indiana University, Bloomington IN 47405 U.S.A.

Orders for monographs from outside Africa should be sent to: Publications, African Studies Program, 221 Woodburn Hall, Indiana University, Bloomington IN 47405 U.S.A.